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PART II:

# DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

## Office of the Assistant Secretary for Housing Production and Mortgage Credit—Federal Housing Commissioner (Federal Housing Administration)

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# MOBILE HOME CONSTRUCTION AND SAFETY STANDARDS

Title 24—Housing and Urban Development

CHAPTER II—OFFICE OF ASSISTANT SECRETARY FOR HOUSING PRODUCTION AND MORTGAGE CREDIT—FEDERAL HOUSING COMMISSIONER (FEDERAL HOUSING ADMINISTRATION), DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

[Docket No. R75-340]

## PART 280—MOBILE HOME CONSTRUCTION AND SAFETY STANDARDS

On June 25, 1975, the Department of Housing and Urban Development proposed Federal mobile home construction and safety standards (40 FR 26930); and on September 2, 1975, (40 FR 40261) published the final rule in the FEDERAL REGISTER pursuant to the requirements of the National Mobile Home Construction and Safety Standards Act of 1974 (Title VI of Pub. L. 93-383, U.S.C. 5401 et seq.). On September 10, 1975, corrections to § 280.305 were published at 40 FR 42007.

On November 11, 1975, the Department published corrections and proposed amendments to the final rule as published on September 2, 1975, (40 FR 52706).

Eighteen comments from consumers, manufacturers, suppliers, trade associations and government agencies were received in response to the proposed rulemaking. In addition, the National Mobile Home Advisory Council met on December 3, 1975, to discuss the November 11, 1975, proposed amendments. At its meeting, the Council also considered recommended revisions to other sections of the standard as published on September 2, 1975. Since the council did not arrive at a consensus, any reference to recommendations made by the council herein are based on HUD's understanding of the views of the majority of the Council members. A summary of the significant issues discussed by the Council follows.

### NATIONAL MOBILE HOME ADVISORY COUNCIL

1. The Council considered the elimination of the "Quick Disconnect" device as proposed in the November 11, 1975, amendments. For purposes of assuring proper installation when connecting fuel gas piping between sections of expandable or multiple mobile homes, the consensus view of the Council was to retain the device as required in the September 2, 1975, Final Rule.

2. The Council considered oil safety controls required by § 280.707(f) and whether these controls should be required on all fuel burning appliances in the form of a thermal cutoff switch with a specific location required for the switch. The majority view of the Council was that the requirement for such controls is redundant when considering other operational controls on the furnace. Discussion also indicated that if such a device was to be required, it should be a part of the furnace listing. The apparent Council minority view was to extend the control requirements to all fuel burning appliances.

3. The Council discussed the proposed amendment to § 280.305(a) which permitted finished flooring up to ⅛" in thickness to be placed under load bearing walls. HUD determined from the Council discussion that additional clarification of the section was needed to resolve the question of whether the ⅛" finished flooring could be compressed from a greater thickness to ⅛" thickness under load bearing walls or if the finished flooring permitted was to be ⅛" uncompressed.

4. The Council discussed having the manufacturer make provisions for heat tape which is used to prevent freezing of exposed plumbing, piping and fixtures. Although in HUD's view there was no clear consensus on this issue, the view most prevalent was to have the manufacturer provide a receptacle outlet for heat tape and clearly specify in his instructions that if a heat tape was used to prevent freezing, it should be listed for use in mobile homes.

5. The Council discussed other provisions relating to installation including gas supply and electrical connections. The consensus view of the Council was that when there are items related to utility hook-up or connection, said connection should be left to local installation, due to the wide variance in requirements by the utilities and local enforcement programs.

### THE STANDARD

After carefully considering the written comments received and issues raised by the Advisory Council, and following Departmental discussions with other Federal and state agencies, amendments to the final rule are being made by HUD.

In order to assist in the use of the standards, the final rule as published on September 2, with corrections made in the September 10, and November 11 FEDERAL REGISTER publications, and with amendments promulgated today, is published consolidated and complete herein.

The following is a discussion, by subpart, of the substantive amendments made to the final rule. Where the amendments were due to comments received, this is so indicated. Otherwise, the amendments are adopted as proposed in notice of proposed rulemaking of November 11, 1975.

*Subpart A. General.* 1. Section 280.1 is revised to add a new paragraph (b). The purpose of this subsection is to make clear that, to the extent possible, the Federal Mobile Home Construction and Safety Standards are written as performance requirements in preference to specification requirements. The subsection also makes it clear that: (1) Whenever specific requirements are used in the Standard, they are used because at this time, this is the best available means of identifying the desired performance and; (2) the use of specifications is not intended to prohibit the utilization of any material, piece of equipment, or system which does not meet the precise specifications but which upon evaluation provides equivalent or superior performance.

2. Section 280.1 is revised to add a new paragraph (c) which establishes a mechanism for the issuance of interpretative bulletins. The purpose of the bulletins would be to clarify the meaning of the various sections of the standard, and to assist in the enforcement of the standard.

The Department received comments requesting that a comment period be provided prior to the issuance of any interpretative bulletins. In order for HUD to make interpretations on a timely basis, a comment period for interpretative bulletins may not always be provided. The Department contemplates that the interpretative bulletins will reflect a wide range of determinations, some of which may indeed deserve publication and opportunity for comment. It is the Department's present intent to provide for a comment period in such cases.

The Department also received comments requesting that the availability of materials be given consideration prior to issuance of an interpretative bulletin. HUD anticipates that its bulletins will describe generic attributes and not specifically name a particular material, and in doing so will endeavor to authorize the use of materials which are in fact in production and available.

3. Section 280.6 is amended by changing the minimum size of the letters and numbers used in the serial numbering of mobile homes from ½ inch to ⅜ inch in height.

*Subpart B. Planning Considerations.* 1. Section 280.102(a) is amended to permit a maximum of 5 square feet of a recessed entry to be included when determining the gross floor area. Section 280.111 is amended to exclude the recessed entry way from the 5 feet minimum clear horizontal room dimension requirement. These changes permit the area encompassed by a standard door swing in a typical recessed entry to be included when determining the gross floor area.

2. Section 280.105(d)(2) is amended to permit the clear height requirement for exterior sliding glass doors to be reduced from 74" to 72" in height.

3. In order to make the language of § 280.404(a) consistent with § 280.106(a), the words "or approved device" are added to permit an alternate means of egress from bedrooms.

*Subpart C. Fire Safety.* 1. As stated in the preamble to the November 11 notice of proposed rulemaking, § 280.208(b) has been revised to clarify the requirements for the specific location of the smoke detector. The detector is now permitted to be located along the hallway space between the living area and the first bedroom. The prior reference to location between the living area and the bedroom door has been deleted. Based upon recommendations from the National Bureau of Standards, the following revisions have also been made:

(a) An exception to the above requirement has been included which permits the detector to be located on the living area side whenever a door is placed

in the hallway space between the living and bedroom areas.

(b) The detector, when practicable, is to be located between the living area and the air return intake.

(c) The architectural planning of a mobile home shall not isolate a smoke detector so as to impair its effectiveness.

HUD has determined the above revisions necessary to assure adequate response time and proper operation of the smoke detector so as to provide sufficient warning in case of fire to sleeping occupants.

2. The definition of "interior finish" has been moved from § 280.302(a)(9) to § 280.202(a)(2) and all appropriate subheadings renumbered.

3. The requirement for "firestopping" in § 280.206(a) is amended to establish a minimum firestop of 1 inch nominal lumber, or its equivalent, for mobile homes.

*Subpart D. Body and Frame Requirements.* 1. The definition of "diagonal tie" in § 280.302(a)(4) is amended to indicate that while its primary purpose is to resist horizontal forces, the tie may also be used to resist vertical forces.

2. Section 280.304 is amended to clarify that each individual wood member need not be marked as having a moisture content of 19% or less. Instead, the moisture content may be measured at the time of installation. (At the time of installation, each individual member shall not have a moisture content exceeding 19%.)

3. Section 280.305(a) as amended permits "uncompressed" finished flooring of up to ⅛ inch thickness under load bearing walls. This change is made in response to the Advisory Council recommendations to clarify HUD's intent with respect to this section.

*Subpart E. Testing.* 1. Since roof truss spacing varies in mobile homes, § 280.402(b)(1) is amended by deleting the 24 inch minimum length requirement for sheathing used in truss testing. The amended section requires that when plywood strip sheathing is used, it be at least of sufficient length to cover the top chords of the trusses being tested at the designated design spacing.

2. Section 280.402(b)(1) is revised to permit an alternate method of bracing the bottom chord of trusses being tested. This revision provides the manufacturer a choice of test methods.

3. Section 280.402(d)(3) limits the equivalent load in lieu of failure to a factor of safety (2.50) times the design live load plus the dead load.

4. Section 280.403(c)(4) is revised by changing the water resistance test to the appropriate ASTM Test Standard (ASTM E-547). This revision is made because the test standard previously referenced was a static test and required an exception for cycle testing. The ASTM Test Standard now referenced is a cyclic test, and does not alter the test procedures previously described.

5. Section 280.403(c) is amended to require production line testing of prime windows and sliding glass doors, in addition to the prototype testing required by the Standards. Production testing and the criteria for the tests to be used were recommended by the industry. The industry suggested, and the regulations provide, that the production units tested meet the prototype requirements, except with respect to the test level for water resistance, where a lower level of testing was recommended. HUD believes that production testing to the level proposed by the industry will result in better quality windows by reducing leakage and energy losses. However, HUD has some concern about the proposed level of testing suggested by the industry for water resistance. Accordingly, HUD will monitor the results of the production unit testing and, based on the experience gained and future research, may establish more stringent tests to demonstrate the performance of prime windows and sliding glass doors.

6. Section 280.403(i) incorporates into the window certification program the specific production line test requirements for prime windows and sliding glass doors. The testing frequency will be initially established by the agency certifying that the windows comply with the standard. Based on the results of HUD monitoring of the window certification program and planned research, HUD may establish the produtcion unit testing frequencies.

*Subpart F. Thermal Protection.* 1. Section 280.504(b) has been amended to conform to the language of § 1423.080(b) as published in the FEDERAL REGISTER on June 25, 1975, (40 FR 26944). This modification is necessary because the required language was inadvertently omitted from the final rule as published.

2. Based on recommendations from the special National Fire Protection Association Energy Task Force on Mobile Homes, the following revisions have been made:

(a) The format for representing transmission heat loss coefficients in § 280.506(a) has been revised, but the substantive requirements of the section remain unchanged.

(b) The table providing specific minimum levels of thermal insulation by climatic zone has been deleted to avoid misinterpretation of its use and meaning.

To assure uniform heat transmission in the mobile home, § 280.506(b) has been changed to require that the cavities in in exterior walls, floors and ceiling be provided with thermal insulation.

*Subpart G. Plumbing Systems.* 1. This revision incorporates the Advisory Council prevalent views for piping protection against freezing. Section 280.603(b)(4) has been revised to require the manufacturer to provide in his written Installation Instructions the method(s) to be used to prevent freezing of exposed piping and fixtures. The manufacturer is to specify in his instructions that when heat tape is used for this purpose, it shall be listed for use in mobile homes. In any case, a receptacle outlet for heat tape shall be installed on each mobile home by the manufacturer and be conveniently located for its use.

2. The requirements for drainage have been moved from § 280.603(b)(5). The words "complete gravity" have been deleted from the section. Drainage of all supply piping would still be required, but such drainage would not have to be achieved by the use of an absolute gravity system. The section has been relocated since the requirement for drainage is general and not limited to freezing.

3. Sections 280.114(b) and 280.607(b)(3) are amended to use the "bathroom floor level" to establish the datum plane from which the height of the shower compartment is to be measured.

4. In response to comments from the industry after September 2, HUD on its initiative, has amended § 280.609(a) to require the manufacturer to include in his written instructions that the mobile home has been designed for an inlet water pressure of 80 PSI and to state that when the mobile home is to be installed in areas where the water pressure exceeds 80 PSI, a pressure reducing valve should be installed. This revision is made by HUD to assure proper operation of the water piping system.

5. In § 280.610(c)(1) the requirement for a "permanent marker" for the drain outlet has been deleted.

*Subpart H. Heating and Cooling Systems.* 1. Section 280.705(a) is amended to clarify the responsibility of the manufacturer with respect to the gas supply system. This revision requires the manufacturer to design the gas piping system in accordance with the pressures listed in § 280.705(a). The manufacturer is now required to provide in his written installation instructions, the pressure range for safe operation of the piping system.

2. Section 280.705(c) remains unchanged from the section as presented in the September 2 final rule so as to require a "quick-disconnect device" for expandable or multiple unit mobile homes. (The November 11, 1975, FEDERAL REGISTER publication proposed an amendment which would have deleted the "quick-disconnect device".)

3. Section 280.705(d) is revised to provide additional design criteria to be used when sizing gas piping by the table(s) method. HUD is providing this criteria to assure uniform application of the tables.

4. Section 280.705(j) is amended to permit the location for all gas supply connections to be within 24 inches of the left (road) sidewall. This revision enables a manufacturer to standardize the location of the gas supply connection for all gas systems.

5. Section 280.705(l)(3) has been amended to indicate that shut-off valves are to be accessible in order to allow servicing of the appliance and removal of its components, and for shut off in case of emergency.

6. HUD has determined that the requirement for oil safety controls in § 280.707(f) of the September 2, 1975, final rule is redundant. The Department has therefore deleted the requirement for the following reasons:

(a) Adequate safety controls are presently provided in oil fired furnaces,

(b) Equipment redesign has eliminated previous melting point problems,

(c) There may be adverse effects to furnace operation and durability associated with indiscriminate power interruption to the circulatory air blower, and

(d) The primary goal in the event of any fire is to remove all occupants from the mobile home, rather than encourage the occupant to remain in a burning unit, while attempting to cut off oil flow in case of a furnace fire.

The deletion of this requirement is also consistent with the majority view of the Advisory Council as perceived by HUD.

7. Section 280.708(a)(1) has been amended to require listing of termination fittings and moisture lint exhaust duct systems for gas clothes dryers only.

8. Section 280.709(e)(5) requires that when a furnace can only be used with a specific coil and the coil has a limited listing, the installation must be in accordance with that listing. This requirement would not prevent heatng and cooling equipment manufacturers from having their product listed for use in equipment manufactured by others.

9. In accordance comments received from the industry, § 280.709(g)(1) has been amended to require that the termination device and spark arrester be included in the listing of factory built chimneys. The specific requirements for the spark arrester indicated in § 280.709 (g)(1)(vii) have therefore been deleted since these specifications are already included in the listing.

This revision is made to be consistent with requirements for residential spark arresters used on factory built chimneys.

*Subpart I. Electrical Systems.* 1. Section 280.803(1)(2) as amended deletes the requirement that the manufacturer install conductors in the electric service raceway which goes to the underside of the mobile home. Instead, it requires that the manufacturer provide in his written installation instructions the proper service conductor sizes and the proper size of the junction box to be installed at the underside of the mobile home.

2. Section 280.806(d)(9) is amended to make clear that the use of receptacle outlet(s) which are integral with the light fixture over the bathroom basin satisfies the requirement for a receptable outlet adjacent to the bathroom basin.

*Subpart J. Transportation.* 1. Section 280.904(b)(5) is revised to delete the reference to the SAE Handbook, and now permits the mobile home manufacturer to use in his design evaluation the allowable stresses recommended by the spring assembly manufacturer.

All of the amendments which in the Department's judgment will have a significant impact on the final rule, as published, have been described above. The Department is presently considering comments submitted by interested parties on specific equipment and installations which may be the subject of interpretative bulletins as described in the preceding discussion on Subpart A.

The amendments to the final rule do not affect the Environmental Impact Statement for the Federal Mobile Home Construction and Safety Standards which was prepared and submitted to the Council on Environmental Quality. It is available for inspection and copying according to Department rules and regulations during regular business hours at the address below.

The amendments to the final rule do not affect the Economic Impact Statement assessing the impact of the Federal Mobile Home Construction and Safety Standards on the economy, the labor force, competition, and material and energy supplies which was prepared and submitted to the Council on Wage and Price Stability. This Statement is available for inspection and copying according to the rules and regulations of the Department during regular business hours in Room 10245, Office of General Counsel, Department of Housing and Urban Development, 451 Seventh Street, SW., Washington, D.C.

FUTURE AMENDMENTS TO THE STANDARD

HUD believes that the proportion of mobile homes and other manufactured housing in the total housing inventory will continue to increase. HUD also expects that future innovation in design, materials, construction methods, equipment components, subsystems, and also new methods of testing and evaluation may make some aspects of the initial Federal mobile home standards obsolete or inadequate.

Recognizing these factors, HUD expects and plans that the standards will evolve in an orderly fashion to meet changing needs and conditions, as have voluntary and state standards in the past.

The office of Mobile Home Standards will have an engineering staff to work on amendments to the standards and to propose and utilize research to support such amendments.

HUD invites comment or other communication at any time from any member of the public or any organization regarding the Federal mobile home standards and possible amendments to those standards.

In consideration of the comments received and pursuant to the authority contained in sections 604 and 625 of the National Mobile Home Construction and Safety Standards Act of 1974 (42 U.S.C. 5403 and 5425), 88 Stat. 701 and 714, Part 280 of 24 CFR is amended and corrected as follows.

*Effective date.* These regulations are effective June 15, 1976.

DAVID M. DEWILDE,
*Deputy Assistant Secretary-Commissioner for Housing Production and Mortgage Credit.*

*Introduction.* The following regulations are in substantial measure based on the Standard for Mobile Homes NFPA 501B–1974/ANSI A119.1–1975 and particularly on sections B, C, D, and E of that standard. In addition, parts of these regulations are derived from state standards, enforcing agency standards, interpretation manuals and trade association standards.

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AUTHORITY: Sec. 7(d), Department of Housing and Urban Development Act, 42 U.S.C. 3535(d), Title VI, Housing and Community Development Act of 1974 (42 U.S.C. 5401).

## Subpart A—General

### § 280.1 Scope.

(a) This standard covers all equipment and installations in the design, construction, fire safety, plumbing, heat-producing and electrical systems of mobile homes which are designed to be used as dwelling units. The Secretary may approve such equipment and installations which are listed or labeled by an approved testing or listing agency. Equipment and installations not listed or labeled may be approved by the Secretary upon a determination that such equipment and installations are adequate for the protection of health, safety and the general welfare.

(b) These Federal Mobile Home Construction and Safety Standards seek, to the maximum extent possible, to establish performance requirements. In certain instances, however, the use of specific requirements in the Standard is necessary because, at this time, that is the best available means of identifying the desired performance. The use of specific requirements is not intended to prohibit the utilization of any material, piece of equipment, or system which cannot meet the precise specifications, but which upon evaluation provides equivalent or superior performance. Where any material, piece of equipment, or system which does not meet precise specifications set out in the standard is shown, to the satisfaction of the Secretary, to meet the level of performance of a material, piece of equipment or system which meets the precise specifications, the Secretary may waive the specifications set out in the standard for that material, piece of equipment, or system. Whenever a waiver is issued, the Secretary shall issue an interpretative bulletin which announces the waiver, states that the material, piece of equipment or system meets the required standard of performance, and sets out any limitations or other requirements with respect to how the material, piece of equipment, or system must be used, including any tests of the material, piece of equipment, or system which the Secretary determines must be carried out before it can be used. Where a waiver has been issued, the requirements of the section of the Federal standard to which the waiver relates may be met either by meeting the specifications set out in the standard or by meeting any requirements set out in the interpretative bulletin which announces the waiver.

(c) Interpretative bulletins may also be issued for the following purposes:

(1) to clarify the meaning of the standard; and

(2) to assist in the enforcement of the standard.

### § 280.2 Definitions.

(a) Definitions in this Subpart are those common to all Subparts of the standard and are in addition to the definitions provided in individual parts.

(1) "Approved," when used in connection with any material, appliance or construction, means complying with the requirements of the Department of Housing and Urban Development.

(2) "Center" means the midline between the right and left side of a mobile home.

(3) "Certified." See "listed."

(4) "Combustible Material" means materials made of, or surfaced with, wood, compressed paper, plant fibers, or other material that will ignite and burn. Such materials shall be considered as combustible even though flameproofed, fire-retardant treated, or plastered.

(5) "Defect" includes any defect in the performance, construction, components, or material of a mobile home that renders the home or any part thereof not fit for the ordinary use for which it was intended.

(6) "Department" means the Department of Housing and Urban Development.

(7) "Dwelling Unit" means one or more habitable rooms which are designed to be occupied by one family with facilities for living, sleeping, cooking and eating.

(8) "Equipment" includes materials, appliances, devices, fixtures, fittings or accessories both in the construction of, and in the fire safety, plumbing, heat-producing and electrical systems of mobile homes.

(9) "Federal mobile home construction and safety standard" means a reasonable standard for the construction, design, and performance of a mobile home which meets the needs of the public including the need for quality, durability, and safety.

(10) "Imminent safety hazard" means a hazard that presents an imminent and unreasonable risk of death or severe personal injury.

(11) "Installations" means all arrangements and methods of construction, as well as fire safety, plumbing, heat-producing and electrical systems used in mobile homes.

(12) "Labeled" means a label, symbol or other identifying mark of a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling is indicated compliance with nationally recognized standards or tests to determine suitable usage in a specified manner.

(13) "Length of a Mobile Home" means the distance from the exterior of the front wall (nearest to the drawbar and coupling mechanism) to the exterior of the rear wall (at the opposite end of the home) where such walls enclose living or other interior space and such distance includes expandable rooms but not bay windows, porches, drawbars, couplings, hitches, wall and roof extensions, or other attachments.

(14) "Listed or Certified" means included in a list published by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

(15) "Manufacturer" means any person engaged in manufacturing or assembling mobile homes, including any person engaged in importing mobile homes for resale.

(16) "Mobile Home" means a structure, transportable in one or more sections, which is eight body feet or more in width and is thirty-two body feet or more in length, and which is built on a permanent chassis, and designed to be used as a dwelling with or without permanent foundation, when connected to the required utilities, and includes the plumb-

ing, heating, air-conditioning, and electrical systems contained therein.

(17) "Mobile Home Construction" means all activities relating to the assembly and manufacture of a mobile home including, but not limited to, those relating to durability, quality and safety.

(18) "Mobile Home Safety" means the performance of a mobile home in such a manner that the public is protected against any unreasonable risk of the occurrence of accidents due to the design or construction of such mobile home, or any unreasonable risk of death or injury to the user or to the public if such accidents do occur.

(19) "Registered Engineer or Architect" means a person licensed to practice engineering or architecture in a state and subject to all laws and limitations imposed by the state's Board of Engineering and Architecture Examiners and who is engaged in the professional practice of rendering service or creative work requiring education, training and experience in engineering sciences and the application of special knowledge of the mathematical, physical and engineering sciences in such professional or creative work as consultation, investigation, evaluation, planning or design and supervision of construction for the purpose of securing compliance with specifications and design for any such work.

(20) "Secretary" means the Secretary of Housing and Urban Development, or an official of the Department delegated the authority of the Secretary with respect to Title VI of Public Law 93-383.

(21) "State" includes each of the several States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, the Virgin Islands, the Canal Zone, and American Samoa.

(22) "Width of a Mobile Home" means the distance from the exterior of one side wall to the exterior of the opposite side wall where such walls enclose living or other interior space and such distance includes expandable rooms but not bay windows, porches, wall and roof extensions, or other attachments.

### § 280.3 Acceptance of plans.

(a) Each manufacturer of mobile homes shall submit the building plans for every model of such mobile home to the Secretary, or Secretary's designee, for the purpose of inspection for conformance to this standard.

(b) The manufacturer shall certify that each such building plan meets the Federal construction and safety standard in force at that time before the mobile home involved is produced.

(c) Regulations pertaining to enforcement of these standards and to labeling of mobile homes shall be as prescribed by the Secretary.

### § 280.4 Incorporation by reference.

(a) The specifications, standards and codes of agencies of the U.S. Government, to the extent they are incorporated by reference in this standard, have the same force and effect as this standard. Wherever reference standards and this standard are inconsistent, the requirements of this standard prevail to the extent of the inconsistency.

(b) The abbreviations and sources of these referenced standards, specifications and codes appear below:

AA—The Aluminum Association, 750 Third Avenue, New York, N.Y. 10017.

ABPA—Acoustical and Board Products Association, 205 West Touhy Avenue, Chicago, Illinois 60068.

AGA—American Gas Association Laboratories, 8501 East Pleasant Valley Road, Cleveland, Ohio 44131.

AISC—American Institute of Steel Construction, 1221 Avenue of the Americas, New York, New York 10020.

AISI—American Iron and Steel Institute, 1000 16th Street, N.W., Washington, D.C. 20036.

AITC—American Institute of Timber Construction, 333 W. Hampden Avenue, Englewood, Colorado 80110.

ANSI—American National Standards Institute, 1430 Broadway, New York, New York 10017.

APA—American Plywood Association, 1119 A Street, Tacoma, Wash. 98401.

ASHRAE—American Society of Heating Refrigeration and Air-conditioning Engineers, 345 East 47th Street, New York, New York 10017.

ASME—American Society of Mechanical Engineers, 345 East 47th Street, New York, New York 10017.

ASTM—American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

CMI—Cultured Marble Institute, 230 North Michigan Avenue, Chicago, Illinois 60601.

CS—Commercial Standards—Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

DOC—Department of Commerce, Washington, D.C. 20230.

DOT—Department of Transportation, Washington, D.C. 20590.

FHDA—Fir and Hemlock Door Association, Yeon Building, Portland, Oregon 97204.

FS—Federal Specification—Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

GAL—Gas Appliance Laboratory, 3138 East Olympic Boulevard, Los Angeles, California 90023.

HPMA—Hardwood Plywood Manufacturers Association, P.O. Box 6246, Arlington, Virginia 22206.

HVI—Home Ventilating Institute, 230 North Michigan Avenue, Chicago, Illinois 60601.

IAPMO—International Association of Plumbing and Mechanical Officials, 5032 Alhambra Avenue, Los Angeles, California 90032.

I-SANTA—Industrial Staple and Nail Technical Association, P.O. Box 3072, City of Industry, California 91744.

NFPA—National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts.

(N)FPA—National Forest Products Association (formerly National Lumber Manufacturers Association), 1619 Massachusetts Ave., Wash., D.C. 20036.

NPA—National Particleboard Association, 2306 Perkins Place, Silver Spring, Maryland 20910.

NSF—National Sanitation Foundation, 3475 Plymouth Road, Ann Arbor, Michigan 48105.

NWMA—National Woodwork Manufacturers Association, 400 West Madison Street, Chicago, Illinois 60606.

PS—Product Standard—Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

SJI—Steel Joist Institute, 2001 Jefferson Davis Highway, Arlington, Virginia 22202.

TPI—Truss Plate Institute, Suite 200, 7100 Baltimore Avenue, College Park, Maryland 20740.

UL—Underwriters' Laboratories, Inc., 207 East Ohio Street, Chicago, Illinois 60611.

### § 280.5 Data plate.

(a) Each mobile home shall bear a data plate affixed in a permanent manner near the main electrical panel or other readily accessible and visible location. Data plates shall bear not less than the following information:

(1) The manufacturer's name and address.

(2) The serial number and the model number of the unit and date the unit was manufactured.

(3) The statement, "The mobile home is designed to comply with the Federal mobile home construction and safety standard in force at the time of manufacture."

(4) Factory installed equipment, the manufacturer's name and the model designation of major factory-installed appliances.

(5) Reference to the structural zone and wind zone for which the home is designed and duplicates of the maps as set forth in § 280.305(c)(4). This information may be combined with the heating/cooling certificate and insulation zone maps required by §§ 280.510 and 280.511.

### § 280.6 Serial number.

(a) A mobile home serial number which will identify the manufacturer and the state in which the mobile home is manufactured, must be stamped into the foremost cross member. Letters and numbers must be ⅜ inch minimum in height. Numbers must not be stamped into hitch assembly or drawbar.

## Subpart B—Planning Considerations

### § 280.101 Scope.

Subpart B states the planning requirements in mobile homes. The intent of this subpart is to assure the adequacy of architectural planning considerations which assist in determining a safe and healthful environment.

### § 280.102 Definitions.

(a) "Gross Floor Area" means all space, wall to wall, including recessed entries not to exceed 5 sq. ft. and areas under built-in vanities and similar furniture. Where the ceiling height is less than that specified in § 280.104, the floor area under such ceilings shall not be included. Floor area of closets shall not be included in the gross floor area.

(b) "Habitable Room" means a room or enclosed floor space arranged for living, eating, food preparation, or sleeping purposes not including bathrooms, foyers, hallways, and other accessory floor space.

(c) "Laundry Area" means an area containing or designed to contain a laundry tray, clothes washer and/or clothes dryer.

### § 280.103 Light and ventilation.

Provisions shall be made for adequate light and ventilation in accordance with the following:

(a) Each habitable room shall be provided with exterior windows and/or doors having a total glazed area of not less than 8 percent of the gross floor area. An area equivalent to not less than 4 percent of the gross floor area shall be available for unobstructed ventilation. Glazed areas need not be openable where a mechanical ventilation system is provided and is capable of producing a change of air in the room(s) every 30 minutes with not less than one-fifth of the air supply taken from outside the mobile home. Windows and doors used for light or ventilation shall open directly to the outside of the home.

(b) In lieu of the requirements in § 280.103(a), kitchens may be provided with artificial light and mechanical ventilation capable of producing a change of air in the room every 30 minutes. (See § 280.710).

(c) Bathroom and toilet compartments. Each bathroom and toilet compartment shall be provided with artificial light and, in addition, be provided with external windows or doors having not less than 1½ sq. ft. of fully openable glazed area, except where a mechanical ventilation system is provided capable of producing a change of air every 12 minutes. Any mechanical ventilation system shall exhaust directly to the outside of the mobile home.

**§ 280.104 Ceiling heights.**

(a) Every habitable room and bathroom shall have a minimum ceiling height of not less than 7 feet, 0 inches for a minimum of 50 percent of the room's floor area. The remaining area may have a ceiling with a minimum height of 5 feet, 0 inches. Minimum height under dropped ducts, beams, etc. shall be 6 feet, 4 inches.

(b) Hallways and foyers shall have a minimum ceiling height of 6 feet, 6 inches.

**§ 280.105 Exit facilities; exterior doors.**

(a) *Number and location of exterior doors.* Mobile homes shall have a minimum of two exterior doors located remote from each other.

(1) Required egress doors shall not be located in rooms where a lockable interior door must be used in order to exit.

(2) In order for exit doors to be considered "remote" from each other, they must comply with all of the following: (i) Both of the required doors must not be in the same room or in a group of rooms which are not defined by fixed walls. (ii) Single wide units. Doors may not be less than 12 ft. c–c from each other as measured in any straight line direction regardless of the length of path of travel between doors. (iii) Double wide units. Doors may not be less than 20 ft. c-c from each other as measured in any straight line direction regardless of the length of path of travel between doors. (iv) One of the required exit doors must be accessible from the doorway of each bedroom without traveling more than 35 ft.

(b) *Door design and construction.* (1) Exterior swinging doors shall be constructed in accordance with § 280.405 the "Standard for Swinging Exterior Passage Doors for Use in Mobile Homes". Exterior sliding glass doors shall be constructed in accordance with § 280.403 the "Standard for Windows and Sliding Glass Doors Used in Mobile Homes".

(2) All exterior swinging doors shall provide a minimum 28 inch wide by 74 inch high clear opening. All exterior sliding glass doors shall provide a minimum 28 inch wide by 72 inch high clear opening.

(3) Each swinging exterior door other than screen or storm doors shall have a key-operated lock that has a deadlocking latch or a key-operated dead bolt with a passage latch. Locks shall not require the use of a key for operation from the inside.

(4) All exterior doors, including storm and screen doors, opening outward shall be provided with a safety door check.

**§ 280.106 Exit facilities; egress windows.**

(a) Every room designed expressly for sleeping purposes, unless it has an exit door (See § 280.105), shall have at least one outside window or approved device which meets the requirements of § 280.404 the "Standard for Egress Windows for Use in Mobile Homes".

(b) The bottom of the window opening shall not be more than 36 inches above the floor.

(c) Locks, latches, operating handles, tabs and any other window, screen or storm window devices which need to be operated in order to permit exiting shall not be located in excess of 60 inches from the finished floor.

**§ 280.107 Interior privacy.**

Bathroom and toilet compartment doors shall be equipped with a privacy lock.

**§ 280.108 Interior passage.**

(a) Interior doors having passage hardware without a privacy lock, or with a privacy lock not engaged, shall open from either side by a single movement of the hardware mechanism in any direction.

(b) Each mobile home interior door, when provided with a privacy lock, shall have a privacy lock that has an emergency release on the outside to permit entry when the lock has been locked by a locking knob, lever, button, or other locking device on the inside.

**§ 280.109 Space planning.**

The dimensions set forth in §§ 280.110 through 280.113 are intended to assure that space and a functional arrangement of this space are provided to accommodate the normal activities of living in the mobile home.

**§ 280.110 Room requirements.**

(a) Every mobile home shall have at least one living area with not less than 150 sq. ft. of gross floor area.

(b) Rooms designed for sleeping purposes shall have a minimum gross square foot floor area as follows:

(1) All bedrooms shall have at least 50 sq. ft. of floor area.

(2) Bedrooms designed for two or more people shall have 70 sq. ft. of floor area plus 50 sq. ft. for each person in excess of two.

(c) Every room designed for sleeping purposes shall have accessible clothes hanging space with a minimum inside depth of 22 inches and shall be equipped with a rod and shelf.

**§ 280.111 Minimum room dimension.**

The gross floor area required by § 280.110(a) and (b) shall have no clear horizontal dimension less than 5 feet except as permitted by § 280.102(a).

**§ 280.112 Toilet compartments.**

Each toilet compartment shall be a minimum of 30 inches in width, except, when the toilet is located adjacent to the short dimension of the tub, the distance from the tub to the center line of the toilet shall not be less than 12 inches. At least 21 inches of clear space shall be provided in front of each toilet.

**§ 280.113 Hallways.**

Hallways shall have a minimum horizontal dimension of 28 inches measured from the interior finished surface to the interior finished surface of the opposite wall. When appliances are installed in a laundry area, the measurement shall be from the front of the appliance to the opposite finished interior surface. When appliances are not installed and a laundry area is provided, the area shall have a minimum clear depth of 27 inches in addition to the 28 inches required for passage. In addition, a notice of the available clearance for washer/dryer units shall be posted in the laundry area. Minor protrusions into the minimum hallway width by doorknobs, trim, smoke detectors or light fixtures are permitted.

**§ 280.114 Glass and glazed openings.**

(a) *Windows and sliding glass doors.* All windows and sliding glass doors shall meet the requirements of § 280.403 the "Standard for Windows and Sliding Glass Doors Used in Mobile Homes".

(b) *Safety glazing.* Glazing in all entrance or exit doors, sliding glass door units (fixed or moving sections), unframed glass doors, unbacked mirrored wardrobe doors (i.e. mirrors not secured to a backing capable of being the door itself), shower and bathtub enclosures and surrounds to a height of 6 feet above the bathroom floor level, storm doors or combination doors, and in panels located within 12 inches on either side of exit or entrance doors shall be of a safety glazing material. Safety glazing material is considered to be any glazing material capable of passing the requirements of ANSI Z97.1–72.

## Subpart C—Fire Safety

**§ 280.201 Scope.**

The purpose of Subpart C of this standard is to specify measures which will provide a reasonable degree of safety from fire for the occupants. It is the intent of this Subpart that mobile homes shall be constructed so as to reduce fire hazards and provide detection of a fire for safe egress.

**§ 280.202 Definitions.**

(a) The following definitions are applicable to Subpart C only:

(1) "Flame Spread" means the propagation of flame over a surface.

(2) "Interior finish" means the surface material of walls, fixed or movable partitions, ceilings and other exposed interior surfaces affixed to the mobile home structure including any material such as paint or wallpaper and the substrate to which they are applied. Interior finish does not include windows and doors or their frames, skylight, trim, moldings, decorations or furnishing which are not affixed to the mobile home structure.

(3) "Single Station Alarm Device" means an assembly incorporating the smoke detector sensor, the electrical control equipment requirement, and the alarm-sounding device in one unit.

(4) "Smoke Detector" means wall mounted detector of the ionization chamber or photoelectric type which detects visible or invisible particles of combustion and operates from the 120 V AC source of electrical power supply.

**§ 280.203 Flame spread limitations and combustibility.**

(a) *Flame spread limitations.* The surface flame spread rating of interior finish materials shall not exceed the following when tested by Standard Method of Test for Surface Burning Characteristics of Building Materials, ASTM E84. The surface flame spread rating of interior finish materials required by § 280.203(a) (4) and (6) may be established using the Surface Flammability of Materials Using a Radiant Heat Energy Source, ASTM E162. Testing shall be by laboratories acceptable to the Secretary.

(1) The interior finish of all walls and partitions shall not have a flame spread rating exceeding 200 except as otherwise specified herein. The flame spread limitation shall not apply to; molding, trim, windows, doors or series of doors not exceeding 4 feet in width, and permanently attached decorative items such as pictures or accent panels constituting not more than 10 percent of the aggregate wall surface in any room or space nor more than 32 square feet in surface area whichever is less.

(2) All ceiling interior finish shall not have a flame spread rating exceeding 200, excluding molding and trim 2 inches or less in width.

(3) Furnace and water heater spaces shall be enclosed by walls, ceiling and doors having an interior finish with a flame spread rating not exceeding 25.

(4) Combustible kitchen cabinet doors, countertops, exposed bottoms and end panels shall not exceed a flame spread rating of 200. Cabinet rails, stiles, mullions and toe strips are exempted.

(5) Exposed interior finishes adjacent to the cooking range shall not have a flame spread rating exceeding 50. Adjacent surfaces are the exposed vertical surfaces between the range top height and the overhead cabinets and/or ceiling and within 6 horizontal inches of the cooking range.

(6) Finish surfaces of plastic bath tubs, shower units and tub or shower doors shall not exceed a flame spread rating of 200.

(b) *Combustibility.* The interior walls and ceiling encasing furnace and water heater enclosures (including doors) and the exposed wall adjacent to the cooking range as defined in § 280.203(a)(5) shall be surfaces with $\frac{5}{16}$ inch gypsum board or material having equivalent fire protective properties. At furnace and water heater spaces all openings for pipes and vents shall be tight-fitted or firestopped.

**§ 280.204 Kitchen cabinet protection.**

(a) The bottom and sides of combustible kitchen cabinets over cooking ranges including a space of 6 inches from the side of the cooking range shall be protected with at least ¼ inch thick asbestos millboard covered with not less than 26 gage sheet metal (.017 stainless steel, .024 aluminum, or .020 copper) or equivalent protection. The protective metal over the range shall form a hood with not less than a 3 inch eyebrow (measuring horizontally from face of cabinet). The hood shall be centered over and at least as wide as the cooking range.

**§ 280.205 Carpeting.**

(a) Carpeting shall not be used under a fuel-fired furnace or water heater.

**§ 280.206 Firestopping.**

(a) Firestopping of 1 inch minimum nominal lumber or the equivalent, shall be provided to cut off all concealed draft openings in all stud walls and partitions, including furred spaces, so placed that the maximum vertical dimension of any concealed space is not over eight feet.

**§ 280.207 Requirements for foam plastic thermal insulating materials.**

(a) *General.* Foam plastic thermal insulating materials shall not be used within the cavity of walls or ceiling or exposed to the interior of the mobile home, unless otherwise specifically approved by HUD, based on accepted tests including full scale room fire testing.

(b) *Specific requirements.* Foam plastic having a flame spread rating of 75 or less may be used as siding backer board or sheathing with a maximum of ⅜-inch thickness when separated from the interior of the mobile home by a minimum of 2-inches of mineral insulation or equivalent fire protective material.

**§ 280.208 Mobile home fire detection equipment.**

(a) *General.* At least one smoke detector (which may be a single-station alarm device) shall be installed in each mobile home to protect each separate bedroom area.

(b) *Smoke detector location.* A smoke detector shall be installed in the hallway or space communicating with the bedroom area.

(1) The specific location shall be in the hallway between the living room area and the first bedroom, except that when a door(s) separates the living area from the bedroom area, the detector shall be installed on the living area side as close to the door(s) as practicable.

(2) Mobile homes having bedrooms separated by any one or combination of common use areas such as kitchen, dining room, living room, or family room (but not a bathroom or utility room), shall have at least two smoke detectors, one detector protecting each bedroom area.

(3) Where practicable, the detector shall be located between the return air intake and the living area.

(4) The architectural planning of the mobile home shall not isolate a smoke detector so as to impair its effectiveness.

(c) *Smoke detectors.* Smoke detectors shall be either the ionization chamber or the photoelectric wall mounted type and shall comply with all the requirements of Underwriters' Laboratories Standard No. 167 for ionization and 168 for photoelectric type detectors. Detectors shall bear the label of a testing and approval laboratory that indicates the smoke detectors have been tested and approved under the requirements of UL 167 or 168. The testing and approved laboratory shall be one which maintains a periodic follow-up service of the labeled devices to ensure compliance with the original approval.

(d) *Installation.* Smoke detectors shall be installed on an interior wall of the mobile home. The top of the detector shall be 5- to 7-inches from the ceiling. The detector mounting shall be attached to an electrical outlet box and the detector connected by a permanent wiring method into a general electrical circuit. There shall be no switches in the circuit to the detector other than the overcurrent protective device protecting the branch circuit.

## Subpart D—Body and Frame Construction Requirements

**§ 280.301 Scope.**

This Subpart covers the minimum requirements for materials, products, equipment and workmanship needed to assure that the mobile home will provide (a) structural strength and rigidity, (b) protection against corrosion, decay, insects and other similar destructive forces, (c) protection against hazards of windstorm, (d) resistance to the elements, and (e) durability and economy of maintenance.

**§ 280.302 Definitions.**

(a) The following definitions are applicable to Subpart D only:

(1) "Anchoring Equipment" means straps, cables, turnbuckles, and chains, including tensioning devices, which are used with ties to secure a mobile home to ground anchors.

(2) "Anchoring System" means a combination of ties, anchoring equipment, and ground anchors that will, when properly designed and installed, resist overturning and lateral movement of the mobile home from wind forces.

(3) "Tie" means strap, cable, or securing device used to connect the mobile home to ground anchors.

"(4) "Diagonal Tie" means a tie intended to primarily resist horizontal forces, but which may also be used to resist vertical forces."

(5) "Vertical Tie" means a tie intended to resist the uplifting or overturning forces.

(6) "Footing" means that portion of the support system that transmits loads directly to the soil.

(7) "Ground Anchor" means any device at the mobile home stand designed to transfer mobile home anchoring loads to the ground.

(8) "Hurricane Resistive Mobile Home" means a mobile home which meets the wind design load requirements for Zone II in § 280.305(c)(2).

(9) "Loads" (i) "Dead Loads" means the weight of all permanent construction including walls, floors, roof, partition, and fixed service equipment. (ii) "Live Load" means the weight superimposed by the use and occupancy of the mobile home, including wind load and snow load, but not including dead load. (iii) "Wind Load" means the lateral or vertical pressure or uplift on the mobile home due to wind blowing in any direction.

(10) "Main Frame" means the structural component on which is mounted the body of the mobile home.

(11) "Pier" means that portion of the support system between the footing and the mobile home exclusive of caps and shims.

(12) "Sheathing" means material which is applied on the exterior side of a building frame under the exterior weather resistant covering.

(13) "Stabilizing Devices" means all components of the anchoring and support systems such as piers, footings, ties, anchoring equipment, ground anchors, and any other equipment which supports the mobile home and secures it to the ground.

(14) "Support System" means a combination of footings, piers, caps, and shims that will, when properly installed, support the mobile home.

### § 280.303 General requirements.

(a) *Minimum requirements.* The design and construction of a mobile home shall conform with the provisions of this standard. Requirements for any size, weight, or quality of material modified by the terms of "minimum," "not less than," "at least," and similar expressions are minimum standards. The manufacturer or installer may exceed these standards provided such deviation does not result in any inferior installation or defeat the purpose and intent of this standard.

(b) *Construction.* All construction methods shall be in conformance with accepted engineering practices to insure durable, livable, and safe housing and shall demonstrate acceptable workmanship reflecting journeyman quality of work of the various trades.

(c) *Structural analysis.* The strength and rigidity of the component parts and/or the integrated structure shall be determined by engineering analysis or by suitable load tests to simulate the actual loads and conditions of application that occur. (See Subparts E and J.)

(d) *Hurricane resistive design.* Only mobile homes which meet the applicable requirements of § 280.305(c)(2) may be designated "Designed for Hurricane Zone." No similar designation which would imply hurricane resistance shall be used when the mobile home does not meet these requirements.

(e) *New materials and methods.* (1) Any new material or method of construction not provided for in this standard and any material or method of questioned suitability proposed for use in the manufacture of the structure shall nevertheless conform in performance to the requirements of this standard.

(2) Unless based on accepted engineering design for the use indicated, all new mobile home materials, equipment, systems or methods of construction not provided for in this standard shall be subjected to the tests specified in paragraph (g) of this section.

(f) *Allowable design stress.* The design stresses of all materials shall conform to accepted engineering practice. The use of materials not identified as to strength or stress grade shall be limited to the minimum allowable stresses under accepted engineering practice.

(g) *Alternate test procedures.* In the absence of listed and prescribed standards, the manufacturer shall develop or cause to be developed necessary tests to demonstrate the structural properties and the significant characteristics of the method employed. Such tests shall be witnessed by an independent licensed professional engineer or architect or by a recognized testing organization. Copies of the test results shall be kept on file by the mobile home manufacturer.

### § 280.304 Materials.

(a) Dimension and board lumber shall not exceed 19 percent moisture content at time of installation.

(b) (1) Standards for some of the generally used materials and methods of construction are listed in the following table. (2) Materials and methods of construction utilized in the design and construction of mobile homes which are covered by the standards in the following table, or any applicable portion thereof shall comply with these requirements. (3) Engineering analysis and testing methods contained in these references shall be utilized to judge conformance with accepted engineering practices required in § 280.303(c). (4) Materials and methods of installation conforming to these standards shall be considered acceptable when installed in conformance with the requirements of this Part. (5) Materials meeting the standards (or the applicable portion thereof) are considered acceptable unless otherwise specified herein or unless substantial doubt exists as to conformance.

| | |
|---|---|
| **Aluminum:** Aluminum Construction Manual, specifications for aluminum structures. | AA–1971 |
| **Steel:** | |
| Specification for the design, fabrication, and erection of structural steel for buildings with supplements 1, 2 and 3 (junior beams meeting ASTM A36 are acceptable if designed to meet the loadings and performance requirements of this standard). | AISC–1973 |
| Specification for the design of cold-formed steel structural members with supplement 1. | AISI–1968 |
| Specification for the design of light-gage cold-formed stainless steel structural members. | AISI–1972 |
| Standard specifications for open web steel joists, J- and H-Series. | AISC and SJI |
| Criteria for structural applications of steel cables for buildings | AISI–1973 |
| **Wood and wood products:** | |
| Hardboard | PS 58, 59, and 60–1973 |
| Hardwood and decorative plywood | USDC PS 51–71 |
| Structural design guide for hardwood plywood | HPMA–SG–71 |
| Timber, structural glued laminated—inspection | AITC–200–1973 |
| Timber, structural glued laminated | USD PS 56–73 |
| Construction and industrial plywood | PS 1–74 |
| Plywood residential construction guide | APA–1975 |
| Design specifications for plywood—lumber components | APA–1974 |
| Fabrication specifications of plywood—lumber components | APA–1975 |
| Stress grade lumber and its fastenings—national design specifications for (and supplement). | (N) FPA–1973 |
| Structural design data—wood | (N) FPA–1970 |
| Span tables for joists and rafters (PS 20–70) | (N) FPA–1973 |
| Working stresses for joists and rafters | (N) FPA–1974 |
| Timber construction standards | AITC–100–1972 |
| Design specifications for light metal plate connected wood trusses. | TPI–74 |
| Span tables for light metal plate connected wooden trusses | TPI, 1972 |
| Particleboard for mobile home decking | NPA 1–73 |
| Mat-formed wood particleboard | CS 236–66 |
| All plywood beams for mobile homes | APA 124–74 |
| Wood flush doors (interior, exterior) | NWMA I.S.1–74 |
| Wood window units | ANSI A200.1–74 (NWMA I.S.2–73) |
| Water repellent preservative treating for millwork | NWMA I.S.–4–70 |

| | |
|---|---|
| Wood and wood products—Continued | |
| Wood patio doors | NWMA I.S.3–70 |
| Other: Gypsum wallboard | ASTM C36 |
| Fasteners: | |
| Nails, brads, staples and spikes, wire, cut and wrought | F.S.FF–N–1 5b |
| Pneumatic and mechanically driven building construction fasteners. | I–SANTA–19–73 |
| Windows and glazing: Transparent safety glazing material used in buildings. | ANSI Z97.1–1972 |
| Unclassified: Building code requirements for minimum design loads in buildings and other structures. | ANSI A58.1–1972 |

(c) Wood products shall be identified as complying with the appropriate standards."

**§ 280.305 Structural design requirements.**

(a) Each mobile home shall be designed and constructed as a completely integrated structure capable of sustaining the design load requirements of this standard and shall be capable of transmitting these loads to stabilizing devices without exceeding the allowable loads stresses or deflections. Roof framing shall be securely fastened to wall framing, walls to floor structure, and floor structure to chassis to secure and maintain continuity between the floor and chassis, so as to resist wind overturning and sliding as imposed by design loads in this Part. Uncompressed finished flooring greater than ⅛ inch in thickness, shall not extend beneath load bearing walls which are fastened to the floor structure.

(b) *Design Loads.* (1) *Design dead loads.* Design dead loads shall be the actual dead load supported by the structural assembly under consideration. (2) *Design live loads.* The design live loads and wind and snow loads shall be as specified in this Section and shall be considered to be uniformly distributed. The roof live load or snow load shall not be considered as acting simultaneously with the wind load and the roof live or snow load and floor live loads shall not be considered as resisting the overturning moment due to wind. (3) When engineering calulations are performed, allowable unit stresses may be increased as provided in the documents referenced in § 280.304 except as shown otherwise in § 280.306(a).

(c) *Wind, Snow and Roof Loads.* (1) *Standard Wind (Zone I).* When a mobile home is not designated as "Hurricane-Resistive," the mobile home and each wind resisting part and portion thereof shall be designed for horizontal wind loads not less than 15 psf and a net uplift load of not less than 9 psf.

(2) *Hurricane Resistive (Zone II).* (i) When a mobile home is designated as "Hurricane Resistive," the home and each wind resisting part and portion thereof shall be designed for horizontal wind loads not less than 25 psf and a net uplift not less than 15 psf. (ii) For exposures in coastal and other areas where wind records indicate significant differences, 125 mph or greater, from the wind loads stated above, the Department may establish more stringent requirements for homes known to be destined for such areas.

(3) *Roof Loads.* (i) Flat, curved and pitched roofs shall be designed to resist the following live loads, applied downward on the horizontal projection as appropriate for the design zone marked on the mobile home:

| | *Pounds per square foot* |
|---|---|
| North Zone | 40 |
| Middle Zone | 30 |
| South Zone | 20 |

(ii) For exposures in areas (mountainous or other) where snow or wind records or experience indicate significant differences from the loads stated above, the Department may establish more stringent requirements for homes known to be destined for sluch areas. For snow lands, such requirements are to be based on a roof snow load of 0.6 of the ground snow load for areas exposed to wind and a roof snow load of 0.8 of the ground snow load for sheltered areas.

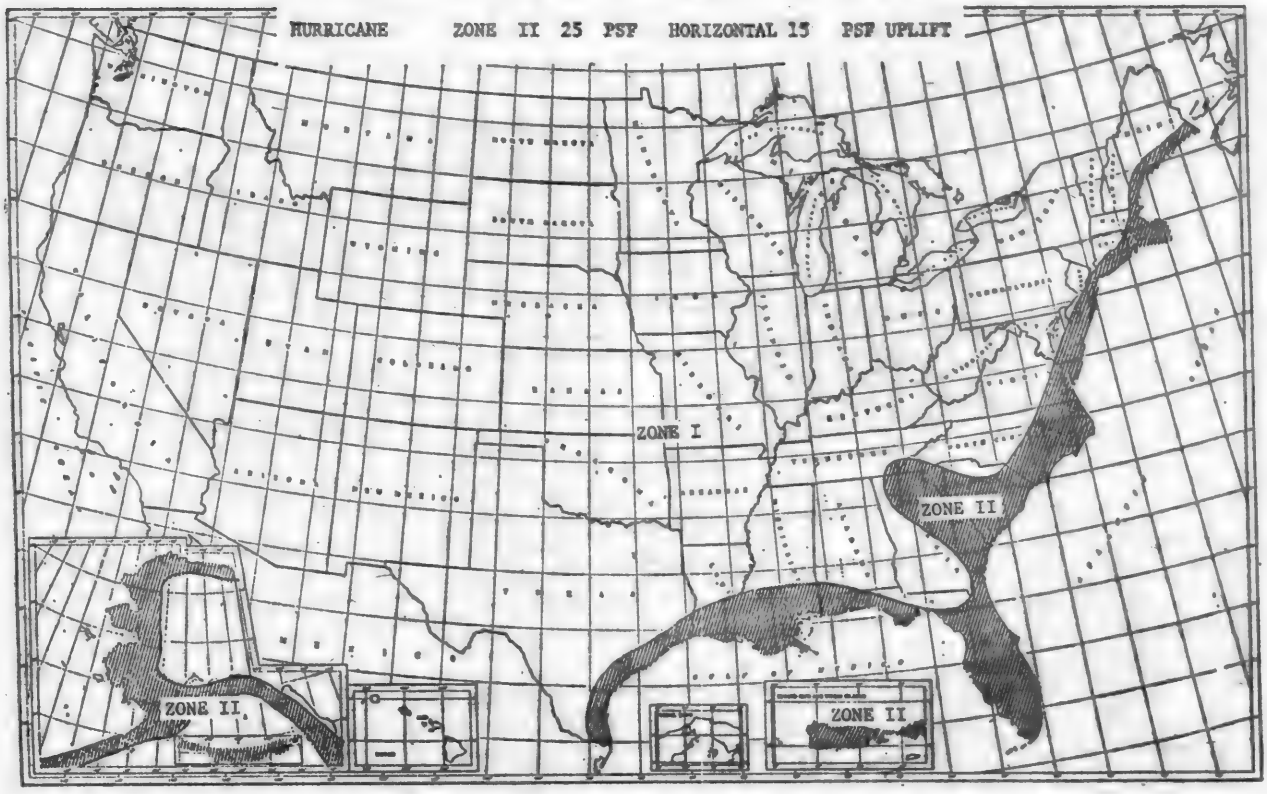
(iii) Eaves and cornices shall be designed for a net uplift pressure of 2.5 times the design uplift wind pressure cited in § 280.305(c) (1) and (2).

(4) The Data Plate posted in the mobile home (See § 280.5) shall show for which structural zone(s) of the USA the mobile home has been designed and the actual design external snow and/or wind live loads. The Data plate shall include reproduction of the Load Zone Maps shown in this Section and related information. The Load Zone Maps shall be not less than one-half the size illustrated.

WIND ZONE MAP

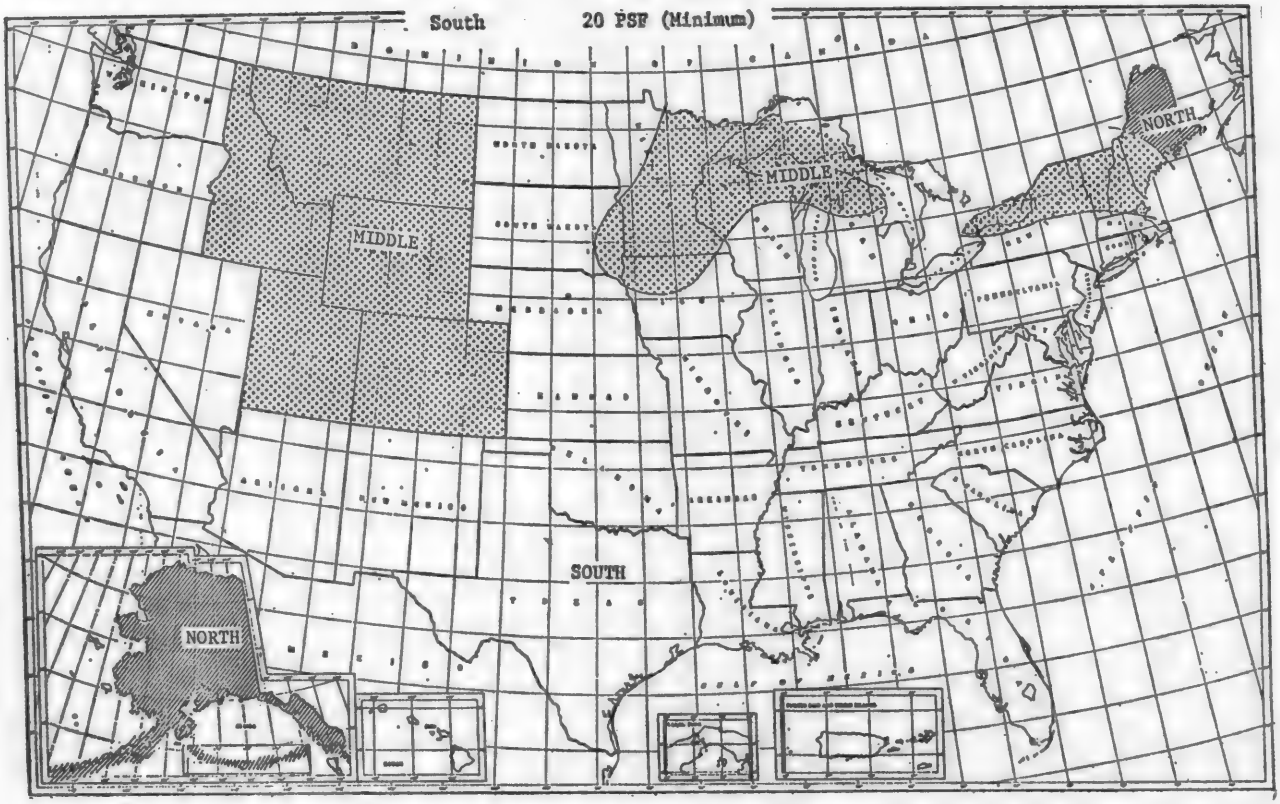
STANDARD WIND ZONE I 15 PSF HORIZONTAL 9 PSF UPLIFT

HURRICANE ZONE II 25 PSF HORIZONTAL 15 PSF UPLIFT



ROOF LOAD ZONE MAP

| | |
|---|---|
| North | 40 PSF (Snow) |
| Middle | 30 PSF (Snow) |
| South | 20 PSF (Minimum) |




(d) *Design Load Deflection.* When a structural assembly is subjected to total design live loads, the deflection for structural framing members shall not exceed the following:

| | |
|---|---|
| Floor | L/240 |
| Roof and ceiling | L/180 |
| Headers, beams, and girders (vertical load) | L/180 |
| Walls and partitions | L/180 |

Where L equals the clear span between supports or two times the length of a cantilever.

(e) *Fastening of Structural Systems.* Roof framing shall be securely fastened to wall framing, walls to floor structure, and floor structure to chassis to secure and maintain continuity between the floor and chassis, so as to resist wind overturning and sliding as imposed by design loads in this Part.

(f) *Walls.* The walls shall be of sufficient strength to withstand the load requirements as defined in § 280.305(c) of this part, without exceeding the deflections as specified in § 280.305(d). The connections between the bearing walls, floor, and roof framework members shall be fabricated in such a manner as to provide support for the material used to enclose the mobile home and to provide for transfer of all lateral and vertical loads to the floor and chassis.

(1) Except where substantiated by engineering analysis or tests, studs shall not be notched or drilled in the middle one-third of their length.

(2) Interior walls and partitions shall be constructed with structural capacity adequate for the intended purpose and shall be capable of resisting a horizontal load of not less than five pounds per square foot. Finish of walls and partitions shall be securely fastened to wall framing.

(g) *Floors.* (1) Floor assemblies shall be designed in accordance with accepted engineering practice standards to support a minimum uniform live load of 40 lb/ft² plus the dead load of the materials. In addition (but not simultaneously), floors shall be able to support a 200-pound concentrated load on a one-inch diameter disc at the most critical location with a maximum deflection not to exceed one-eighth inch relative to floor framing. Perimeter wood joists of more than six inches depth shall be stabilized against overturning from superimposed loads as follows: at ends by solid blocking not less than two-inch thickness by full depth of joist, or by connecting to a continuous header not less than two-inch thickness and not less than the depth of the joist with connecting devices; at eight-feet maximum intermediate spacing by solid blocking or by wood cross-bridging of not less than one inch by three inches, metal cross-bridging of equal strength, or by other approved methods.

(2) Wood, wood fibre or plywood floors or subfloors in kitchens, bathrooms (including toilet compartments), laundry rooms, water heater compartments, and any other areas subject to excessive moisture shall be moisture resistant or shall be made moisture resistant by sealing or by an overlay of nonabsorbent material applied with water-resistant adhesive. Carpets and/or carpet pads shall not be installed in concealed spaces subject to excessive moisture such as plumbing fixture spaces.

(3) Except where substantiated by engineering analysis or tests:

(i) Notches on the ends of joists shall not exceed one-fourth the joist depth.

(ii) Holes bored in joists shall not be within 2 inches of the top or bottom of the joist, and the diameter of any such hole shall not exceed one-third the depth of the joist.

(iii) Notches in the top or bottom of the joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span.

(4) Bottom board material (with or without patches) shall meet or exceed the level of 48 inch-pounds of puncture resistance as tested by the Beach Puncture Test in accordance with ASTM D-781-68. The material shall be suitable for patches and the patch life shall be equivalent to the material life. Patch installation instruction shall be included in the mobile home manufacturer's instructions.

(h) *Roofs.* (1) Roofs shall be of sufficient strength to withstand the load requirements as defined in § 280.305 (b) and (c) without exceeding the deflections specified in § 280.305(d). The connections between roof framework members and bearing walls shall be fabricated in such a manner to provide for the transfer of design vertical and horizontal loads to the bearing walls and to resist uplift forces.

(2) Roofing membranes shall be of sufficient rigidity to prevent deflection which would permit ponding of water or separation of seams due to wind, snow, ice, erection or transportation forces.

(3) Cutting of roof framework members for passage of electrical, plumbing or mechanical systems shall not be allowed except where substantiated by engineering analysis.

(4) All roof penetrations for electrical, plumbing or mechanical systems shall be properly flashed and sealed. In addition, where a metal roof membrane is penetrated, a wood backer shall be installed. The backer plate shall be not less than 5/16 inch plywood, with exterior glues, secured to the roof framing system beneath the metal roof, and shall be of a size to assure that all screws securing the flashing are held by the backer plate.

**§ 280.306 Windstorm protection.**

(a) *Provisions for support and anchoring systems.* Each mobile home shall have provisions for support and anchoring systems, which, when properly designed and installed, will resist overturning and lateral movement (sliding) of the mobile home as imposed by the respective design loads. The design wind loads to be utilized for calculating resistance to overturning and lateral movement shall be the wind loads indicated in § 280.305(c) (1) and (2) increased by a factor of safety of 1.5. The basic allowable stresses of materials required to resist overturning and lateral movement shall not be increased in the design and proportioning of these members.

(1) The provisions of this section shall be followed and the support and anchoring systems shall be designed by a Registered Professional Engineer or Architect.

(2) The manufacturer of each mobile home is required to make provision for the support and anchoring systems but is not required to provide the anchoring equipment or stabilizing devices. When the manufacturer's installation instructions provide for the main frame structure to be used as the points for connection of diagonal ties, no specific connecting devices need be provided on the main frame structure.

(b) The manufacturer shall provide printed instructions with each mobile home specifying the location and required capacity of stabilizing devices on which the design is based. The manufacturer shall provide drawings and specifications certified by a registered professional engineer indicating at least one acceptable system of anchorage including the details of required straps or cables, their end connections and all other devices needed to transfer the wind loads from the mobile home to the ground anchors.

(c) The provisions made for anchoring systems shall be based on the following design criteria for mobile homes.

(1) The minimum number of ties required per side shall be as required to resist the design loads stated in § 280.305 (c) (1) and (2).

(2) Ties shall be as evenly spaced as practicable along the length of the mobile home with not more than 8 feet open-end spacing on each end.

(3) When continuous straps are provided as vertical ties, such ties shall be positioned at rafters and studs. Where a vertical tie and diagonal tie are located at the same place, both ties may be connected to a single ground anchor, provided that the anchor used is capable of carrying both loadings.

(4) Add-on sections of expandable mobile homes shall have provisions for vertical ties at the exposed ends.

(d) Double-wide mobile homes require only diagonal ties. These shall be placed along the main frame and below the outer side walls.

(e) Protection shall be provided at sharp corners where the anchoring system requires the use of external cables or straps. Protection shall also be provided to minimize damage to roofing or sliding by the cable or strap.

(f) Anchoring equipment shall be capable of resisting an allowable working load equal to or exceeding 3,150 pounds and shall be capable of withstanding a 50 percent overload (4,725 pounds total) without failure of either the anchoring equipment or the attachment point on the mobile home.

(g) Anchoring equipment exposed to weathering shall have a resistance to weather deterioration at least equivalent to that provided by a coating of zinc on steel of not less than 0.30 ounces per square foot of surface coated.

(1) Slit or cut edges of zinc-coated steel strapping do not need to be zinc coated.

(2) Type 1, Finish B, Grade 1 steel strapping, 1¼ inches wide and 0.035 inch thick, conforming with Federal Specification QQ-S-781-H, is judged to conform with the provisions of this section and paragraph (f) above.

**§ 280.307 Resistance to elements and use.**

(a) Exterior coverings shall be of moisture and weather resistive materials attached with corrosion resistant fasteners to resist wind, snow and rain. Metal coverings and exposed metal structural members shall be of corrosion resistant materials or shall be protected to resist corrosion. All joints between portions of the exterior covering shall be designed, and assembled to protect against the infiltration of air and water, except for any designed ventilation of wall or roof cavity.

(b) Joints between dissimilar materials and joints between exterior coverings and frames of openings shall be protected with a compatible sealant suitable to resist infiltration of air or water.

(c) Where adjoining materials or assemblies of materials are of such nature that separation can occur due to expansion, contraction, wind loads or other loads induced by erection or transportation, sealants shall be of a type that maintains protection against infiltration or penetration by air, moisture or vermin.

(d) Exterior surfaces shall be sealed to resist the entrance of rodents.

## Subpart E—Testing

**§ 280.401 Structural load tests.**

Every structural assembly tested shall be capable of meeting the Proof Load Test or the Ultimate Load Test as follows:

(a) *Proof load tests.* Every structural assembly tested shall be capable of sustaining its dead load plus superimposed live loads equal to 1.75 times the required live loads for a period of 12 hours without failure. Tests shall be conducted with loads applied and deflections recorded in ¼ design live load increments at 10-minute intervals until 1.25 times design live load plus dead load has been reached. Additional load shall then be applied continuously until 1.75 times design live load plus dead load has been reached. Assembly failure shall be considered as design live load deflection (or residual deflection measured 12 hours after live load removal) which is greater than the limits set in § 280.305(d), rupture, fracture, or excessive yielding. An assembly to be tested shall be of the minimum quality of materials and workmanship of the production. Each test assembly, component or subassembly shall be identified as to type and quality or grade of material. All assemblies, components or subassemblies qualifying under this section shall be subject to a continuing qualification testing program acceptable to the Department.

(b) *Ultimate load tests.* Ultimate load tests shall be performed on a minimum of three assemblies to generally evaluate the structural design. Every structural assembly tested shall be capable of sustaining its total dead load plus live loads increased by a factor of safety consistent with the material being tested. Factors of safety shall be based on nationally recognized standards and approved by the Department. Tests shall be conducted with loads applied and deflections recorded in ¼ design live load increments at 10-minute intervals until 1.25 times design live load plus dead load has been reached. Additional loading shall then be applied continu-

ously until failure occurs or 1.50 times the factor of safety times the design live load plus the dead load is reached. Assembly failure shall be considered as design live load deflection greater than the limits set in § 208.305(d) rupture, fracture, or excessive yielding. Assemblies to be tested shall be representative of average quality or materials and workmanship of the production. Each test assembly, component, or subassembly shall be identified as to type and quality or grade of material. All assemblies, components, or subassemblies qualifying under this section shall be subject to a periodic qualification testing program acceptable to the Department.

**§ 280.402 Test procedure for roof trusses.**

(a) *Roof load tests.* The following is an acceptable test procedure, consistent with the provisions of § 280.401, for roof trusses that are supported at the ends and support design loads. Where roof trusses act as support for other members, act as cantilevers, or support concentrated loads, they shall be tested accordingly.

(b) *General.* Trusses may be tested in pairs or singly in a suitable test facility. When tested singly, simulated lateral support of the test assembly may be provided, but in no case shall this lateral support exceed that which is specified for the completed mobile home. When tested in pairs, the trusses shall be spaced at the design spacing and shall be mounted on solid support accurately positioned to give the required clear span distance (L) as specified in the design. The top and bottom chords shall be braced and covered with the material, with connections or method of attachment, as specified by the completed mobile home.

(1) As an alternate test procedure, the top chord may be sheathed with ¼ inch by 12 inch plywood strips. The plywood strips shall be at least long enough to cover the top chords of the trusses at the designated design truss spacing. Adjacent plywood strips must be separated by at least ⅛ inch. The plywood strip shall be nailed with 4d nails or equivalent staples not closer than 8 inches on center along the top chord of one truss only. The bottom chords of the adjacent trusses may be either: (i) Unbraced, (ii) laterally braced together (not cross braced) with 1" x 2" stripping not closer than 24 inches on center nailed with only one 6d nail at each truss, or (iii) covered with the material, with connections or methods of attachment, as specified for the completed mobile home.

(2) Truss deflections will be measured relative to a taut wire running over the support and weighted at the end to insure constant tension or other approved methods. Deflections will be measured at the two quarter points and at midspan. Loading shall be applied to the top chord through a suitable hydraulic, pneumatic, or mechanical system, masonry units, or weights to simulate design loads. Load units for uniformly distributed loads shall be separated so that arch action does not occur, and shall be spaced not greater than 12 inches on center so as to simulate uniform loading.

(c) *Nondestructive test procedure—* (1) *Dead load plus live load.* (i) Noting figure A, measure and record initial elevation of the truss in test position at no load. (ii) Apply load units to the top chord of the truss equal to the full dead load of roof and ceiling. Measure and record deflections. (iii) Maintaining the dead load, add live load in approximate ¼ design live load increments. Measure the deflections after each loading increment. Apply incremental loads at a uniform rate such that approximately one-half hour is required to establish the total design load condition. Measure and record the deflections five minutes after loads have been applied. The maximum deflection due to design live load (deflection measured in step (iii) minus step (ii)) shall not exceed L/180, where L is a clear span measured in the same units. (iv) Continue to load truss to dead load plus 1.75 times the design live load. Maintain this loading for 12 hours and inspect the truss for failure. (v) Remove the total superimposed live load. Trusses not recovering to at least the L/180 position within 12 hours shall be considered as failing.

(2) *Uplift loads.* This test shall only be required for truss designs which may be critical under uplift load conditions. (i) Measure and record initial elevation of the truss in an inverted test position at no load. Bottom chord of the truss shall be mounted in the horizontal position. (ii) Apply the uplift load as stated in § 280.305(c) to the bottom chord of the truss. Measure and record the deflections 5 minutes after the load has been applied. (iii) Continue to load the truss to 1.75 times the design uplift load. Maintain this load for 3 hours and inspect the truss for failure. (iv) Remove applied loads and within three hours the truss must recover to at least L/180 position, where L is a clear span measured in the same units.

(d) *Destructive test procedure.* (1) Destructive tests shall be performed on three trusses to generally evaluate the truss design. (2) Noting figure A–1, apply the load units to the top chord of the truss assembly equal to full dead load of roof and ceiling. Measure and record deflections. Then apply load and record deflections in ¼ design live load increments at 10-minute intervals until 1.25 times design live load plus dead load has been reached. (3) Additional loading shall then be applied continuously until failure occurs or the factor of safety times the design live load plus the dead load is reached. (4) Assembly failure shall be considered as design live load deflection greater than the limits set in § 280.305(d), rupture, fracture, or excessive yielding. (5) The assembly shall be capable of sustaining the dead load plus the applicable factor of safety times the design live load (the applicable factor of safety for wood trusses shall be taken as 2.50).

(e) Trusses qualifying under the nondestructive test procedure, Tests §§ 208.-402(c) (1) and (2) (when required), shall be subject to a continuing qualification testing program acceptable to the Department. Trusses qualifying under the destructive test procedures, Tests § 280.402 (c)(2) (when required), and (d), shall be subject to periodic tests only.

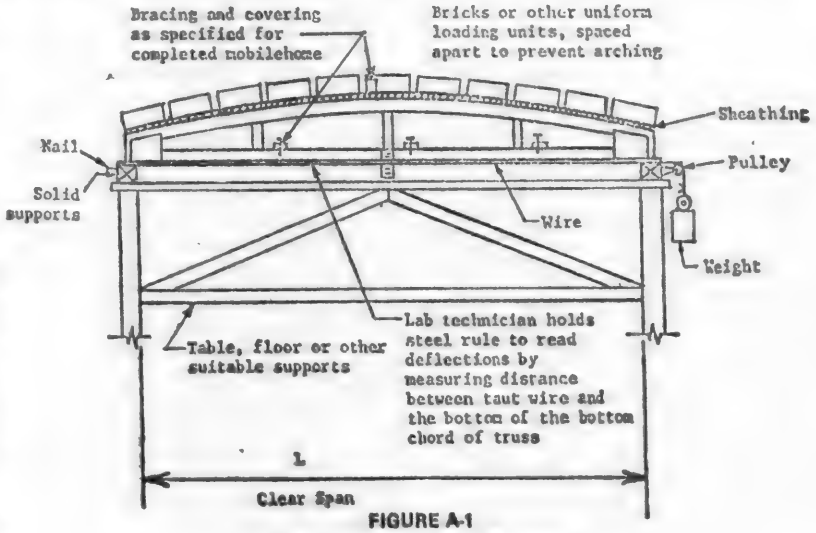

Bracing and covering as specified for completed mobilehome
Bricks or other uniform loading units, spaced apart to prevent arching
Sheathing
Nail
Pulley
Solid supports
Wire
Weight
Lab technician holds steel rule to read deflections by measuring distance between taut wire and the bottom of the bottom chord of truss
Table, floor or other suitable supports
L
Clear Span

**FIGURE A-1**
**Test Procedure for Roof Trusses**

**§ 280.403 Standard for windows and sliding glass doors used in mobile homes.**

(a) *Scope.* This section sets the requirements for prime windows and sliding glass doors used in mobile homes except for windows used in entry doors. Windows so mounted are components of the door and thus are excluded from this standard.

(b) *Materials and methods.* Any material or method of construction, whether or not provided for in this standard, and any material or method of questioned suitability, proposed for use in manufacture, shall nevertheless conform in performance as outlined in paragraph (c) of this Section and proof of capability of structural integrity shall be presented. If applicable, units shall comply with the following:

(1) *Wood and wood based products.* (i) *Wood.* Wood parts including plywood and particleboard parts of window units shall have a moisture content of 6 to 12 percent at the time of fabrication. Wood parts, except inside stops and trim shall be manufactured utilizing wet-use adhesive requirements as defined in ASTM D–3110 and preservative treated in accordance with NWMA IS–4. (ii) *Plywood.* Plywood parts except for inside stops and trim shall be exterior type plywood and preservative treated in accordance with NWMA IS–4. (iii) *Particleboard.* Particleboard parts except for inside stops and trim shall be type-2 particleboard and preservative treated in accordance with NWMA IS–4.

(2) *Aluminum.* (i) *Alloys.* Aluminum shall be of a commercial quality and of proper alloy for window construction, free from defects impairing strength and/or durability, as follows:

Wrought aluminum alloys shall be those in which the alloying elements do not exceed the following maximum limits:

| | *Percent* |
|---|---|
| Silicone | 7.0 |
| Magnesium, Manganese, Chromium (combined) | 6.0 |
| Iron | 1.0 |
| Copper | .4 |
| Zinc | 1.0 |
| Other | .5 |
| Aluminum | Balance |

These limits apply to both bare products and to the core clad products. The cladding of clad products shall be within the same limits except that the maximum zinc limit may be 3.0 percent in order to assure that the cladding is anodic to the core. Where aluminum extrusions are used for the main frame and sash or ventilator sections, they shall have a minimum ultimate tensile strength of 22,000 psi and a yield of 16,000 psi.

(ii) *Finish.* The exposed surface of all aluminum members shall be clean and free from serious surface blemishes. If exposed welded joints are used, they shall be dressed and finished.

(3) *Glass.* (i) Safety glazing materials, where used, shall meet ANSI Z97.1–1972. Tempered glass, where used, shall also meet FS DD–G–1403A. (ii) Insulated glass, when used, shall meet or exceed the requirements of Sealed Insulating Glass Manufacturers Association (SIGMA) and shall be permanently identified with the name of the insulating glass manufacturer. (iii) Glass tolerances and areas shall meet or exceed the values shown in the Glass Table below.

*Glass dimensional tolerances [a] and maximum allowable areas [b]—sheet glass*

| Nominal thickness (inches) | Minimum thickness (inches) | Maximum area [b] (square feet) at 15 lb/ft² | Maximum area [b] (square feet) at 25 lb/ft² |
|---|---|---|---|
| 18 oz | 0.078 | 11 | 10 |
| SS | .085 | 13 | 11 |
| 24 oz | .108 | 18 | 14 |
| DS | .115 | 20 | 15 |
| 3/16 | .182 | 40 | 30 |
| 7/32 | .206 | 55 | 37 |
| 1/4 | .236 | 72 | 48 |

[a] For other types of glass see Federal Specification DD–G–451c, dated Jan. 15, 1968.

[b] Maximum areas shown are based on minimum glass thicknesses set forth. Maximum areas shown apply for rectangular lites of annealed glass firmly supported on all 4 sides in a vertical position.

Tabulated areas may be increased as noted for use of tempered, heat strengthened or sealed insulating glass and shall be decreased as noted for use of sandblasted, wire or laminated glass. Glass louvers installed in jalousies shall be not less than 7/32" thick nor longer than 36" and exposed edges shall be seamed, ground or polished.

ADJUSTMENT FACTORS
RELATIVE RESISTANCE TO WIND LOADS [1]

| Glass type: | *Approximate relationship* |
|---|---|
| Regular plate | 1.0 |
| Laminated | 0.6 |
| Wire | 0.5 |
| Heat strengthened | 2.0 |
| Fully tempered | 4.0 |
| Factory fabricated insulating glass [2] | 1.5 |
| Rough rolled or patterned surface | 1.0 |
| Sand blasted annealed glass | 0.4 |

[1] To determine the maximum allowable area for the glass types listed multiply the allowable area established by the appropriate adjustment factor.

[2] Use thickness of thinner of the two lights, not thickness of unit.

(4) *Glazing.* Any method of glazing conforming to the Performance Requirements (paragraph c of this section) and Material and Methods Requirements (paragraph b of this section) shall be acceptable.

(5) *Hardware and Fasteners.* All hardware components and fasteners when considered as individual components, whether commercially available, or proprietary, must be capable of performing to the criteria stipulated in Performance Requirements, paragraph (c) of this section.

(c) *Performance Requirements.* Test procedures as outlined in pargaraphs (c) (1) thru (4) of this section are applicable to preproduction prototype units of prime windows and sliding glass doors. Production line units shall be equivalent in design and materials to the tested and passed prototype units and shall also meet the requirements of 280.403(c) (5).

(1) *Size of test specimen.* Production line units shall have width and height dimensions equal to or less than the corresponding dimensions of the prototype unit tested and passed. No inference of compliance to these requirements is to be made for products exceeding the size of the tested and passed prototype.

(2) *Structural performance test*—(i) *Zone I.* There shall be no glass breakage, permanent deflection or any other condition which would cause the specimen to be inoperable after being subjected to an exterior pressure, 15 pounds per square foot. The test method applicable to this requirement shall be ASTM E–330. (ii) *Zone II.* There shall be no glass breakage, permanent deflection or any other condition which would cause the specimen to be inoperable after being subjected to exterior pressure of 25 pounds per square foot. The test method applicable to this requirement shall be ASTM E–330. (iii) *Interior pressure.* There shall be no glass breakage, permanent deflection or any other condition which would cause the specimen to be inoperable after being subjected to an interior pressure equal to ½ the requirements in either paragraphs (c) (2) (i) or (c) (2) (ii). The test method applicable to this requirement shall be ASTM E–330 except that no artificial means of containing pressure shall be allowed. Should pressure not be obtainable due to lack of air the testing agency will report the pressure achieved, the theoretical air flow supplied to the unit, and certify that no additional flow from the equipment in use was available. Laboratory equipment used for this test must be capable of developing 10 x air flow determined in § 280.403(c) (3).

(3) *Air infiltration test.* Air infiltration shall not exceed 0.50 CFM per square foot of window area when tested in accordance with ASTM E–283 at an exterior pressure differential of 1.567 pounds per square foot (0.30" of water pressure).

(4) *Water resistance test.* No leakage shall pass the interior face of the test specimen at a test pressure of 2.86 psf (0.55" water pressure) when tested in accordance with ASTM E–547 with a test period consisting of four cycles, each cycle consisting of five minutes with pressure released, during which the water spray will be continuously applied. (i) For the purpose of compliance with paragraph (c) (4), all units which may have exterior screens, shall be tested first with screens in place and thereafter with screens removed. (ii) For the purpose of compliance with paragraph (c) (4), penetration, as referenced in ASTM E–331–70, paragraph 4.3, shall not include drops passing the interior face by energy developed in the bursting of sill drain system bubbles created by a pressure differential applied to the exterior face of the specimen.

(5) *Production Line Units.* Production line units of prime windows and sliding glass doors shall comply with: (i) The structural performance test to the zone limit certified in paragraph (c) (2) of this section and; (ii) the air infiltration test in paragraph (c) (3) of this section and; (iii) the water resistance test in paragraph (c) (4) of this section except that the test pressure shall be 1.56

psf (0.30" water column) and the water application rate shall be 2.5 GPH, per square foot of window surface area, all other parameters being the same as set forth in paragraph (c) (4) of this section.

(d) *Test sequence.* The sequence of tests shall be performed as they are listed above except that Structural Performance Test to Zone I (15 PSF) exterior pressure may be followed by Zone I interior pressure (7.5 PSF), which may be followed by the Air Infiltration Test, which may be followed by the Water Resistance Test, which may be followed by the Structural Performance Test to Zone II and (25 PSF) exterior pressure, which may be followed by the Zone II and interior pressures (12.5 PSF), which may be followed by the Air Infiltration Test, which may be followed by the Water Resistance Test. The Air Infiltration Test may be performed after the Water Resistance Test providing all sealed areas are thoroughly dried.

(e) *Screens.* (1) Screen, when specified, shall be provided with fastening devices, suited particularly for application to the specific window for which they are intended, and be of sufficient strength to perform satisfactorily.

(2) Insect screening shall be of a material compatible with aluminum and shall meet CS 138–55, "Insect Wire Screening," FS RR–W–365, "Screening, Wire, Insect," CS 248–64, "Vinyl Coated Glass Fibre Insect Screening and Louver Cloth," or FS L–S–125a "Screening, Non Metallic Insect."

(f) *Assembly.* Windows shall be assembled in a secure and workmanlike manner to perform as hereinafter specified and to assure neat and weather tight construction. A permanent-type watertight joint shall be made at the junction of the sill and side frame members.

(g) *Shipping.* Units may be shipped either as a subassembly unit or as a completely assembled unit but not as a KD or open unit. A KD unit is a unit that is complete in its entirety with the exception of glass, glazing material, or screen, which is shipped in a disassembled condition and later assembled and glazed according to the instructions of the manufacturer and utilizing all of the components supplied or specified by the manufacturer.

(1) An open unit is a unit that is complete in its entirety with the exception of glass, glazing materials, or screen, which is shipped in an assembled condition and later glazed according to the instruction of the manufacturer, utilizing all of the components supplied by the manufacturer.

(2) A subassembly unit is a unit that is complete in its entirety including the glazing of glass or other glazing panels into their respective fixed or moving sash frames, which is shipped with such glazed panels separate from each other or from any master frame, which master frame may be either disassembled or assembled. The connection of such master frame to glazed, fixed, or moving panels is to take place later according to the instructions of the manufacturer utilizing all of the components supplied by the manufacturer.

(3) A completely assembled unit is one that is complete in its entirety and is shipped with all parts and subassemblies in complete connection with each other and no separate pieces.

(h) *Permanent identification.* (1) As identification, each unit shall bear a certification label containing a code number traceable to the manufacturer through the certifying agency or the name of the manufacturer or brand name together with the city and state location of the manufacturer or main office of the manufacturer.

(2) The label shall be of a permanent-type designed to discourage easy removal, shall be legible and shall remain legible under normal operating conditions for a period of not less than five years from date of product installation.

(3) Acceptable means of identification are, but are not limited to, the following: Embosed, stamped, cast or molded characters becoming an integral part of the material on which they are located; flexible color-fast and durable labels, decals, stickers, etc., affixed with a permanent-type adhesive; or rigid metal or plastic name plates affixed mechanically or with a permanent-type adhesive.

(4) Location of the label shall be such that it is accessible for normal direct viewing purposes from the interior side of the product, after the unit is installed, without the necessity of product disassembly. Identification located only on the glass or screen shall not be acceptable.

(i) *Certification.* The manufacturer shall show evidence of continued compliance by affixing a quality certification label to the product in accordance with ANSI Z34.1, "American National Standard Practice for Certification Procedures." In determining certifiability under this section, compliance shall consist of preproduction specimen testing in accordance with each and every requirement of this section followed by an in-plant inspection and production unit testing system consisting of a minimum of two such inspections per year by an independent quality assurance agency.

### § 280.404 Standard for egress windows for use in mobile homes.

(a) *Scope and purpose.* The purpose of this section is to establish the requirements for the design, construction, and installation of windows and approved devices intended to be used as an emergency exit during conditions encountered in a fire or similar disaster.

(b) *Requirements*—(1) *Installation.* Window manufacturers shall provide the home manufacturer with written installation instructions.

(2) *Performance.* The egress window including auxiliary frame and seals, if any, shall meet the requirements of § 280.403 "Standard for Windows and Sliding Glass Doors Used in Mobile Homes."

(3) *Dimensions.* (i) All egress windows shall have a minimum clear dimension of 22 inches when determined in accordance with Test A paragraph (d) (1) of this section. (ii) All egress windows shall have a minimum clear opening of 5 square feet when determined in accordance with Test B, paragraph (d) (2) of this section.

(4) *Operational.* (i) Operating instructions shall be applied to each egress window and carry the legend "Do Not Remove." In addition, the instructions should include a reminder to remove all shipping clips on screens, storm windows, and other appurtenances for exiting purposes. (ii) The number of locks and latches shall not exceed 2, not including the 4 appurtenance attachment mechanisms permitted by paragraph (c) (2) (i) of this section. (iii) Locks, latches, lifting and sliding operational forces shall not exceed a force of 20 pounds when tested in accordance with Test C, paragraph (d) (3) of this section. (iv) Any handle or latch required to operate the emergency egress provisions of the window shall be attached in the factory by either a permanent method or a mechanical method which requires a tool not commonly available in the home, unless removal of the latch or handle will in no way limit the effectiveness of the egress provision. (v) Any window whose egress provisions are dependent on the operation of a rotary operator is unacceptable.

*Example:* Awning windows utilizing a single vent for egress and requiring a rotary operator for activation is unacceptable, whereas an awning window set in a separate frame whose activation requires only a 180° twist of the lock to allow egress is acceptable even though a rotary operator is present for normal operation.

(c) *Appurtenances.* (1) The addition or inclusion of screens, storm windows, or other appurtenances shall not encroach upon the dimensional requirements set forth in paragraph (b) (3).

(2) Any mechanism used to attach an appurtenance such as a screen or storm window to the window shall meet the following requirements unless the appurtenance meets the requirements of paragraph (c) (3): (i) The number of mechanisms shall not exceed 4 and; (ii) The operating force of the mechanisms shall not exceed 5 pounds tested in accordance with Test D paragraph (d) (4) and; (iii) The mechanisms shall be designed so that that cannot be misapplied utilizing normal household tools such as screwdrivers, pliers and wrenches exceeding the aforementioned forces; and (iv) The surface to which the operating force is applied shall have a minimum cross-sectional area of 0.25 square inches.

(3) If an appurtenance such as a screen or storm window is attached to the window in such a manner that it need not be removed or disengaged in any way in order to effect a fully opened exit, the requirements of paragraph (c) (2) need not be met.

(4) The operating instructions detailed in paragraph (b) (4) (i) shall include instructions on the required removal and replacement of any screen and/or storm sash appurtenance.

(d) *Test methods*—(1) *Test Method A—Minimum Dimensions.* The minimum dimension of 22 in. required by paragraph (b) (3) (i) shall be tested as follows: When the window is in the final position for egress, a 22 in. dowel shall

be passed through the opening at the point of its least dimension while contacting only one point of the window frame, at either the horizontal or vertical orientation of the dowel. (i) Example: In a horizontally opening window (sliding or rolling), the minimum dimension requirement may be met as follows: When the window is in the final position for egress, place one end of the dowel perpendicularly against the portion of the main frame side (bottom) projecting furthest towards the center of the opening, and pass the dowel through the opening in a horizontal (vertical) plane without touching any portion of the device except the main frame side (bottom) on which it is pivoted. (ii) Example: Any type of window may be mounted in a side, bottom, or top hinged or pop-out egress frame which in the fully opened position meets the minimum dimension and area requirements.

(2) *Test Method B—Minimum Area.* The minimum area requirement of 5 square feet contained in paragraph (b) (3) (ii) shall be determined by multiplying the minimum dimension (which may exceed 22 in.) by the clear dimension measured perpendicularly to the minimum dimension and in the plane of the window main frame. (i) Example: In a vertically operating window whose minimum dimension is from the main frame bottom to that portion of the operating vent projecting furthest toward the horizontal center line of the egress opening when in the fully opened position, the minimum area shall be determined by multiplying the minimum dimension by the inside side-to-side dimension.

(3) *Test Method C—Operating Forces.* (i) For horizontal or vertical moving windows, a force gage shall be attached to the manual pull bar at its centerpoint. After opening the latch or lock, a force not to exceed 20 pounds shall be exerted in a direct pull parallel to the window in order to obtain movement in the opening direction. The window shall be in the closed and latched position prior to the test and shall have been subjected to 5 opening and closing cycles prior to the test. (ii) Locks and latches shall be tested as noted in section (d) (3) (i) except that the force gage shall be located in the center of the latch or lock handle.

(4) *Test Method D—Mechanical Device Operating Force (Appurtances).* (i) A force gage of sufficient capacity using a point contact and having the ability to retain the maximum reading (Chatillion DPP–50 or similar) shall be used. The force gage point shall be applied to the mechanism at the center of the normal force application area and sufficient force applied to disengage the appurtenance. The maximum reading shall be retained by the force gage and may be read directly.

(e) *Test Report.* (1) The test report shall include all requirements of this standard listed in their order shown in this standard. Where certain provisions of the standard do not apply, the notation "N.A." (Not applicable) shall so denote these items. Where certain appurtenances are not supplied; such as storm windows or screen, the notation "N.S." (Not supplied) shall so denote those items.

(2) The test report shall be complete with manufacturers assembly drawing, extrusion drawings, parts list, weatherstrip description, glazing method, description including backbedding and glazing method, installation and operating instructions. Where the unit tested is not in its actual installation, a clause stating the following shall be included in the test report: "This unit tested as submitted. Actual installation must be in accordance with the instructions included with this report or this report is not valid."

(3) The test report on all units submitted for test not having appurtenances listed in paragraph (c) shall include a statement as follows: "This unit tested without storm windows (or screen). The installation of these items with this product invalidates this test report."

(4) For any test on component parts, such as balances, friction positioners, etc., certification by an independent testing agency shall be acceptable for evidence of compliance. If such certification is used, the test report shall so state, and give the name of the agency.

(5) Test reports used to demonstrate compliance with this standard to any governmental body shall be made available to the public upon request.

### § 280.405 Standard for swinging exterior passage doors for use in mobile homes.

(a) *Introduction.* This standard applies to all exterior passage door units, excluding sliding doors and doors used for access to utilities and compartments. This standard applies only to the door frame consisting of jambs, head and sill and the attached door or doors.

(b) *Purpose.* It is the purpose of this standard to establish the requirements for exterior passage door units irrespective of the type of material used in the manufacture of these products.

(c) *General requirements and materials of construction.* (1) The design and construction of the exterior passage door units shall conform with the provisions of this standard. Requirements for any size, weight, or quality of material modified by the terms of "minimum," "not less than," "at least," and similar expressions are minimum standards. The manufacturer may exceed these standards provided such deviation does not result in an inferior product or defeat the purpose and intent of this standard. Units may be shipped as a completely assembled unit, but not as KD or open unit. A KD unit is a unit that is complete in its entirety, which is shipped in a dissassembled condition and later assembled and glazed according to the instructions of the manufacturer. An open unit is a unit that is complete in its entirety with the exception of a window insert, which is shipped in an assembled condition and later glazed according to the instructions of the manufacturer. A completely assembled unit is one that is complete in its entirety and is shipped with all parts and subassemblies in complete connection with each other and no separate pieces, except for: Lock-knobs only and keys, door chain and attachments, storm door latch, chain and attachments, threshold extension, screw cover, drip cap.

(2) *Workmanship.* All construction methods, materials and workmanship shall be in conformance with accepted engineering practices to insure durable, livable, and safe housing.

(d) *Materials and methods.* Any material or method of construction, whether or not provided for in this standard, and any material or method of questioned suitability, proposed for use in manufacture, shall nevertheless conform in performance as outlined in paragraph (e) of this standard and proof of capability of structural integrity shall be presented. If applicable, units shall comply with the following:

(1) *Wood and wood based products*—(i) Wood. Wood door parts shall be manufactured of suitable lumber having a moisture content of 6 to 12 percent at time of fabrication. Wood parts except interior trim shall be manufactured utilizing wet-use adhesive requirements as defined in ASTM D–3110 and Preservative Treated in accordance with NWMA I.S.–4 standard. Doors shall conform to the Type 1 requirements of NWMA I.S. 1–74. (ii) Plywood. Plywood shall be exterior type and preservative treated in accordance with NWMA I.S.–4. (iii) Hardboard parts shall meet or exceed the requirements for ⅛ inch tempered hardboard in accordance with the latest edition of PS 58.

(2) *Hardware and fasteners.* All hardware components and fasteners when considered as individual components, whether commercially available, or proprietary, must be capable of performing to the criteria stipulated in this section and in the Performance Requirements Section, Paragraph (e) of these specifications.

(3) *Glass.* All glazing in doors shall be safety glazing material meeting ANSI Z97.1–72. Glass in jalousies shall also be at least 7/32 in. in thickness and not longer than 36 inches. Exposed edges shall be seamed, ground or polished to prevent injury.

(4) *Weatherstripping.* A tight threshold and weatherstripping to reduce air infiltration and improve water resistance shall be provided capable of conforming to the criteria stipulated in the Performance Requirements Section, Paragraph (e) of this standard.

(e) *Performance requirements*—(1) *Size of test specimen.* All tests shall be performed on exterior passage door units with all operable portions closed and all criteria herein are applicable to exterior passage doors of the largest type that the producer desires to qualify under this specification. No inference of compliance to these requirements is to be made for products exceeding the size of the test specimen submitted. Largest unit size is determined by the maximum width and height dimensions of production units that are equal to or less than correspond-

ing dimensions in that unit tested and passed.

(2) *Structural performance test*—(i) *Wind pressure resistivity.* There shall be no glass breakage or permanent deflection or any other condition which would cause the specimen to be inoperable after being subjected to exterior pressures of 25 pounds per square foot. The test method applicable to this requirement shall be ASTM E–330. (ii) *Interior pressure.* There shall be no glass breakage or permanent deflection or any other condition which would cause the specimen to be inoperable after being subjected to an interior pressure equal to ½ the requirements in paragraph (e)(2)(i). The test method applicable to this requirement shall be ASTM E–330 except that no artificial means of containing pressure shall be allowed. Should pressure not be obtainable due to lack of air, the testing agency will report the pressure achieved, the theoretical air flow supplied to the unit, and certify that no additional flow from the equipment in use was available. Laboratory equipment used for this test must be capable of developing 10 x air flow determined in paragraph (e)(2)(iii) of this specification. (iii) *Air infiltration test.* Air infiltration shall not exceed the limits set forth below when tested in accordance with ASTM E–283 at an exterior pressure differential of 1.56 pounds per square foot (0.300" water pressure).

| | |
|---|---|
| 1.35 CFM per sq. ft. of door | Jan. 1, 1975. |
| 1.2 CFM per sq. ft. of door | Jan. 1, 1976. |
| 1.0 CFM per sq. ft. of door | Jan. 1, 1977. |

(iv) *Water resistance test.* No water shall pass the interior face of the test specimen at a test pressure of 0 psf when tested in accordance with ASTM E–331. (v) The sequence of tests shall be performed as they are listed above. The Air Infiltration Test may be performed after the Water Resistance Test providing all sealed areas are thoroughly dried.

## Subpart F—Thermal Protection

### § 280.501 Scope.

This subpart sets forth the requirements for condensation control, air infiltration, thermal insulation and certification for heating and comfort cooling.

### § 280.502 Definitions.

(a) The following definitions are applicable to Subpart F only:

(1) "Pressure Envelope" means that primary air barrier surrounding the living space which serves to limit air leakage. In construction using ventilated cavities, the pressure envelope is the interior skin.

(2) "Thermal Envelope Area" means the sum of the surface areas of outside walls, ceiling and floor, including all openings. The wall area is measured by multiplying outside wall lengths by the inside wall height from floor to ceiling. The floor and ceiling areas are considered as horizontal surfaces using exterior width and length.

### § 280.503 Materials.

Materials used for insulation shall be of proven effectiveness and adequate durability to assure that required design conditions concerning thermal transmission are attained.

### § 280.504 Condensation control (vapor barriers).

(a) *Ceilings.* Ceilings shall have a vapor barrier having a permeance not greater than 1 perm (dry cup method) installed on the living space side of the roof cavity.

(b) Exterior walls. (1) Exterior walls shall have a vapor barrier not greater than 1 perm (dry cup method) installed on the living space side of the wall, or (2) Unventilated wall cavities shall have an external covering and/or sheathing which forms the pressure envelope. The covering and/or sheathing shall have a combined permeance of not less than 5.0 perms. In the absence of test data, combined permeance may be computed using the formula:

$$P_{Total}=\frac{1}{\frac{1}{P_1}+\frac{1}{P_2}}$$

where $P_1$ and $P_2$ are the permeance values of the exterior covering and sheathing in perms.

Formed exterior siding applied in sections with joints not caulked or sealed shall not be considered to restrict water vapor transmission, or (3) Wall cavities shall be constructed so that ventilation is provided to dissipate any condensation occurring in these cavities.

### § 280.505 Air infiltration.

(a) *Envelope air infiltration.* The opaque envelope shall be designed and constructed to limit air infiltration to the living area of the home. Any design, material, method or combination thereof which accomplishes this goal may be used. The goal of the infiltration control criteria is to reduce heat loss/heat gain due to infiltration as much as possible without impinging on health and comfort and within the limits of reasonable economics.

(1) *Envelope penetrations.* Plumbing, mechanical and electrical penetrations of the pressure envelope not exempted by this part, and installations of window and door frames shall be constructed or treated to limit air infiltration. Penetrations of the pressure envelope made by electrical equipment, other than distribution panel boards and cable and conduit penetrations, are exempt from this requirement. Cable penetrations through outlet boxes are considered exempt.

(2) *Joints between major envelope elements.* Joints not designed to limit air infiltration between wall-to-wall, wall-to-ceiling and wall-to-floor connections shall be caulked or otherwise sealed. When walls are constructed to form a pressure envelope on the outside of the wall cavity, they are deemed to meet this requirement.

### § 280.506 Heat loss.

The mobile home heat loss/heat gain shall be determined by methods outlined in §§ 280.508 and 280.509. The outdoor winter design temperature zone for which the mobile home is acceptable and the lowest outdoor temperature to which the installed heating equipment will maintain a temperature of 70 F shall be certified as specified in § 280.510 of this subpart.

(a) Transmission Heat Loss Coefficient. The overall coefficient of heat transmission of the mobile home for the respective zones and an indoor design temperature of 70 F, including internal and external ducts, and excluding infiltration ventilation and condensation control, shall not exceed the B.T.U./(hr.) (sq. ft) (F) of the mobile home envelope area as tabulated below

| Zone: | *Maximum transmission coefficient* |
|---|---|
| I | .157 Btu/(hr.) (sq. ft.) (F3 |
| II | .126 Btu/(hr.) (sq. ft.) (F) |
| III | .104 Btu/(hr.) (sq. ft.) (F) |

(b) To assure uniform heat transmission in mobile homes, cavities in exterior walls, floors, and ceilings shall be provided with thermal insulation.

(c) Mobile homes designed for Zones II and III shall be factory equipped with storm windows or insulating glass.

### § 280.507 Comfort heat gain.

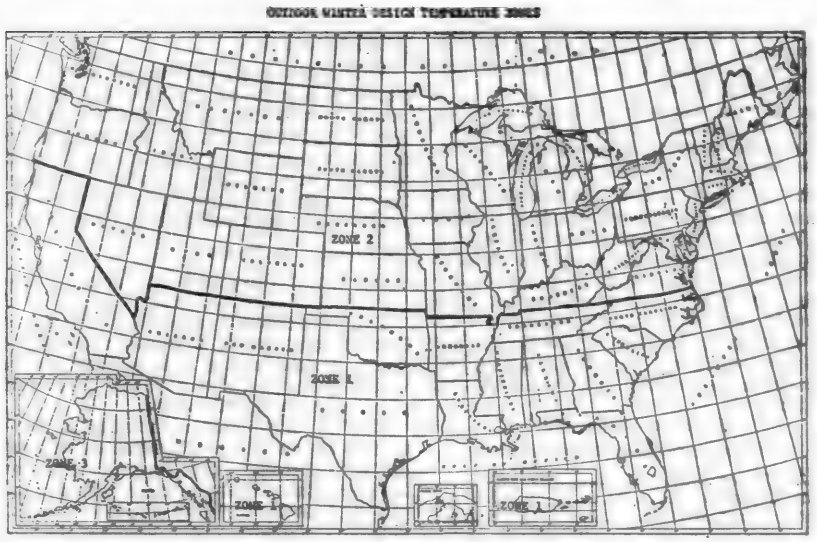
Information necessary to calculate the home cooling load shall be provided as specified in this Part.

(a) *Transmission heat gains.* Homes complying with this section shall meet the minimum heat loss transmission coefficients specified in § 280.506(a).

### § 280.508 Heat loss, heat gain and cooling load calculations.

Information, values and data necessary for heat loss and heat gain determinations shall be taken from the 1972 ASHRAE Handbook of Fundamentals.

Infiltration and Ventilation—Chapter 19.
Determining "R" & "U" Value—Chapter 20.
Heating Load—Chapter 21.
Cooling Load Calculations—Chapter 22.
Outdoor Winter Design Temperatures (Use 97½ percent values)—Chapter 33.
Outdoor Summer Design Temperatures (Use 2½ percent values)—Chapter 33.




**§ 280.509 Criteria in absence of specific data.**

In the absence of specific data, for purposes of heat-loss/gain calculation, the following criteria shall be used:

(a) *Infiltration Heat Loss.* In the absence of measured infiltration heat loss data, the following formula shall be used to calculate heat loss due to infiltration and intermittently operated fans exhausting to the outdoors. The perimeter calculation shall be based on the dimensions of the pressure envelope.

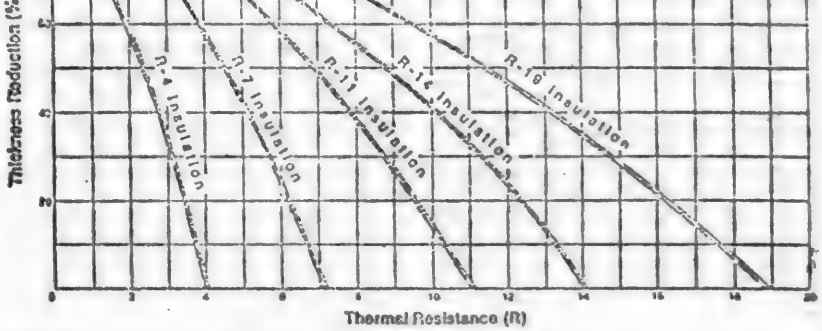
Infiltration Heat-Loss=0.7 (T) (ft. of perimeter), BTU/hr.

where: T=70 minus the heating system capacity certification temperature stipulated in the Heating Certificate, in F.

(b) *Framing areas.*

| | |
|---|---|
| Wall | 15 percent of wall area less windows and doors. |
| Floor and Ceiling | 10 percent of the area. |

(c) *Insulation compression.* Insulation compressed to less than nominal thickness shall have its nominal R-values reduced for that area which is compressed in accordance with the following graph:




When insulation is installed over the framing members the thermal performance of the insulation is reduced due to compression at the framing members. The Resistance value of the insulation between the framing members is reduced by 12.5 percent for framing members 16" O.C., 8.5 percent for framing members 24" O.C., and 4 percent for framing members 48" O.C.

(d) *Air supply ducts within floor cavity.* Air supply ducts located within a floor cavity shall be assumed to be heating or cooling the floor cavity to living space temperatures unless the duct is structurally isolated by the framing system or thermally insulated from the rest of the floor cavity with a thermal insulation at least equal to R-4.

(e) *Air supply ducts within ceiling cavity.* Where supply ducts are located in ceiling cavities, the influence of the duct on cavity temperatures shall be considered in calculating envelope heat loss or heat gain.

(f) The supply duct loss (and/or heat gain where applicable—See § 280.511) shall be calculated using the actual duct surface area and the actual thickness of insulation between the duct and outside of the mobile home. If there is an air space of at least ½ inch between the duct and the insulation, heat loss/gain need not be calculated if the cavity in which the duct is located is assumed to be at living space temperature. The average temperature inside the supply duct, including ducts installed outside the mobile home, shall be assumed to be 130 F for purposes of calculation of heat loss and 60 F for heat gain.

(g) *Return air cavities.* Cavities used as return air plenums shall be considered to be at living space temperature.

**§ 280.510 Heat loss certificate.**

The mobile home manufacturer shall permanently affix the following "Certificate" to an interior surface of the home that is readily visible to the homeowner. The "Certificate" shall specify the following:

(a) *Heating zone certification.* The design zone at which the mobile home heat loss complies with § 280.506(a).

(b) *Outdoor certification temperature.* The lowest outdoor temperature at which the installed heating equipment will maintain a 70 F temperature inside the home without storm sash or insulating glass for Zone I and with storm sash or insulating glass or Zones II and III and complying with §§ 280.508 and 280.509.

HEATING CERTIFICATE

Home Manufacturer _____

Plant Location _____

Home Model _____

(Include Winter Climate Zone Map)

This mobile home has been thermally insulated to conform with the requirements of the Federal Mobile Home Construction and Safety Standards for all locations within climatic Zone ——.

Heating Equipment Manufacturer _____

Heating Equipment Model _____

The above heating equipment has the capacity to maintain an average 70 F temperature in this home at outdoor temperatures of —— F.

To maximize furnace operating economy, and to conserve energy, it is recommended that this home be installed where the outdoor winter design temperature (97½%) is not higher than —— degrees Fahrenheit.[1]

The above information has been calculated assuming a maximum wind velocity of 15 MPH at standard atmospheric pressure.

**§ 280.511 Comfort cooling certificate and information.**

(a) The mobile home manufacturer shall permanently affix a "Comfort Cooling Certificate" to an interior surface of the home that is readily visible to the home owner. This certificate may be combined with the heating certificate required in § 280.511. The manufacturer shall comply with one of the following

[1] The temperature to be specified shall be 20 F or 30% of the design temperature difference, whichever is greater, added to the temperature specified as the heating system capacity certification temperature without storm windows or insulating glass for Zone I and with storm windows or insulating glass for Zones II and III. Design temperature difference is 70 minus the heating system capacity certification temperature in degrees Fahrenheit.

three alternatives in providing the certificate and additional information concerning the cooling of the mobile home:

(1) *Alternative 1.* If a central air conditioning system is provided by the home manufacturer, the heat gain calculation necessary to properly size the air conditioning equipment shall be in accordance with procedures outlined in Chapter 22 of the ASHRAE Handbook of Fundamentals, with an assumed location and orientation. The following information shall be supplied on the Comfort Cooling Certificate:

"Air Conditioner Manufacturer_____
Air Conditioner Model_____
Certified Capacity—B.T.U./Hr. in accordance with the appropriate Air Conditioning and Refrigeration Institute Standards.

The central air conditioning system provided with this home has been sized, assuming an orientation of the front (hitch) end of the home facing _____ and is designed on the basis of a 75 F indoor temperature and an outdoor temperature of —— F dry bulb and —— F wet bulb."

*Example Alternate 1*

COMFORT COOLING CERTIFICATE

Mobile Home Mfg_____
Plant Location _____
Mobile Home Model _____
Air Conditioner Manufacturer _____
Air Conditioner Model _____

Certified Capacity—B.T.U./Hr. in accordance with the appropriate Air Conditioning and Refrigeration Institute Standards.

The central air conditioning system provided with this home has been sized assuming an orientation of the front (hitch end) of the home facing _____. On this basis the system is designed to maintain an indoor temperature of 75 F when outdoor temperatures are —— F dry bulb and —— F wet bulb.

The temperature to which this home can be cooled will change depending upon the amount of exposure of the windows of this home to the sun's radiant heat. Therefore, the home's heat gains will vary dependent upon its orientation to the sun and any permanent shading provided. Information concerning the calculation of cooling loads at various locations, window exposures and shadings are provided in Chapter 22 of the 1972 edition of the ASHRAE Handbook of Fundamentals.

Information necessary to calculate cooling loads at various locations and orientations is provided in the special comfort cooling information provided with this mobile home.

(2) *Alternative 2.* For each home suitable for a central air cooling system, the manufacturer shall provide the following statement: "This air distribution system of this home is suitable for the installation of a central air conditioning system."

*Example Alternate 2*

COMFORT COOLING CERTIFICATE

Mobile Home Manufacturer_____
Plant Location_____
Mobile Home Model_____

This air distribution system of this home is suitable for the installation of central air conditioning.

The supply air distribution system installed in this home is sized for Mobile Home Central Air Conditioning System of up to —— B.T.U./Hr. rated capacity which are certified in accordance with the appropriate Air Conditioning and Refrigeration Institute Standards. When the air circulators of such air conditioners are rated at 0.3 inch water column static pressure or greater for the cooling air delivered to the mobile home supply air duct system.

Information necessary to calculate cooling loads at various locations and orientations is provided in the special comfort cooling information provided with this mobile home.

(3) *Alternative 3.* If the mobile home is not equipped with an air supply duct system, or if the manufacturer elects not to designate the home as being suitable for the installation of a central air conditioning system, the manufacturer shall provide the following statement: "This air distribution system of this home has not been designed in anticipation of its use with a central air conditioning system."

*Example Alternate 3*

COMFORT COOLING CERTIFICATE

Mobile Home Mfg_____
Plant Location_____
Mobile Home Model_____

The air distribution system of this home has not been designed in anticipation of its use with a central air conditioning system.

(b) For each home designated as suitable for central air conditioning the manufacturer shall provide the maximum central mobile home air conditioning capacity certified in accordance with the appropriate A.R.I. standards and in accordance with § 280.715(a)(3). If the capacity information provided is based on entrances to the air supply duct at other than the furnace plenum, the manufacturer shall indicate the correct supply air entrance and return air exit locations.

(c) *Comfort cooling information.* For each mobile home designated, either "suitable for" or "provided with" a central air conditioning system, the manufacturer shall provide comfort cooling information specific to the mobile home necessary to complete the cooling load calculations. The comfort cooling information shall include a statement to read as follows:

To determine the required capacity of equipment to cool a home efficiently and economically, a cooling load (heat gain) calculation is required. The cooling load is dependent on the orientation, location and the structure of the home. Central air conditioners operate most efficiently and provide the greatest comfort when their capacity closely approximates the calculated cooling load. Each home's air conditioner should be sized in accordance with Chapter 22 of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbooks of Fundamentals, once the location and orientation are known.

INFORMATION PROVIDED BY THE MANUFACTURER NECESSARY TO CALCULATE SENSIBLE HEAT GAIN

| | | |
|---|---|---|
| Walls (without windows and doors) | "U" | _____ |
| Ceilings and roofs of light color | "U" | _____ |
| Ceilings and roofs of dark color | "U" | _____ |
| Floors | "U" | _____ |
| Air ducts in floor | "U" | _____ |
| Air ducts in ceiling | "U" | _____ |
| Air ducts installed outside the home | "U" | _____ |

Information necessary to calculate duct area

## Subpart G—Plumbing Systems

### § 280.601 Scope.

Subpart G of this Standard covers the plumbing materials, fixtures, and equipment installed within or on mobile homes. It is the intent of this subpart to assure water supply, drain, waste and vent systems which permit satisfactory functioning and provide for health and safety under all conditions of normal use.

### § 280.602 Definitions.

(a) The following definitions are applicable to Subpart G only:

(1) "Accessible," when applied to a fixture, connection, appliance or equipment, means having access thereto, but which may require removal of an access panel or opening of a door.

(2) "Air Gap (Water Distribution System)" means the unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture, water supplied appliances, or other device and the flood level rim of the receptacle.

(3) "Anti-Siphon Trap Vent Device" means a device which automatically opens to admit air to a fixture drain above the connection of the trap arm so as to prevent siphonage, and closes tightly when the pressure within the drainage system is equal to or greater than atmospheric pressure so as to prevent the escape of gases from the drainage system into the mobile home.

(4) "Backflow" means the flow of water or other liquids, mixtures, or substances into the distributing pipes of a potable supply of water from any source or sources other than its intended sources.

(5) "Backflow Connection" means any arrangement whereby blackflow can occur.

(6) "Backflow Preventer" means a device or means to prevent backflow.

(7) "Branch" means any part of the piping system other than a riser, main or stack.

(8) "Common Vent" means a vent connecting at the junction of fixture drains and serving as a vent for more than one fixture.

(9) "Continuous Vent" means a vertical vent that is a continuation of the drain to which it connects.

(10) "Continuous Waste" means a drain from two or more fixtures connected to a single trap.

(11) "Critical Level" means a point established by the testing laboratory (usually stamped on the device by the manufacturer) which determines the minimum elevation above the flood level rim of the fixture or receptacle served on which the device may be installed. When a backflow prevention device does not bear a critical level marking, the bottom of the vacuum breaker, combination valve, or of any such approved or listed device shall constitute the critical level.

(12) "Cross Connection" means any physical connection or arrangement between two otherwise separate systems or sources, one of which contains potable water and the other either water, steam,

gas or chemical of unknown or questionable safety whereby there may be a flow from one system or source to the other, the direction of flow depending on the pressure differential between the two systems.

(13) "Developed Length" means that length of pipe measured along the center line of the pipe and fittings.

(14) "Diameter," unless otherwise specifically stated, means the nominal (inside) diameter designated commercially.

(15) "Drain" means a pipe that carries waste, water, or water-borne waste in a drainage system.

(16) "Drain Connector" means the removable extension, consisting of all pipes, fittings and appurtenances, from the drain outlet to the drain inlet serving the mobile home.

(17) "Drain Outlet" means the lowest end of the main or secondary drain to which a sewer connection is made.

(18) "Drainage System" means all piping within or attached to the structure that conveys sewage or other liquid waste to the drain outlet, not including the drain connector.

(19) "Fixture Drain" means the drain from the trap of a fixture to the junction of that drain with any other drain pipe.

(20) "Fixture Supply" means the water supply pipe connecting a fixture to a branch water supply pipe or directly to a main water supply pipe.

(21) "Flood-Level" means the level in the receptacle over which water would overflow to the outside of the receptacle.

(22) "Flooded" means the condition which results when the liquid in a container or receptacle rises to the flood-level.

(23) "Flush Tank" means that portion of a toilet that is designed to contain sufficient water to adequately flush the fixture.

(24) "Flush Valve" means a device located at the bottom of a flush tank for flushing a toilet.

(25) "Flushometer Valve" means a device which discharges a predetermined quantity of water to a fixture for flushing purposes and is closed by direct water pressure.

(26) "Grade" means the fall (slope) of a pipe in reference to a horizontal plane expressed in inches per foot length.

(27) "Horizonal Branch" means any pipe extending laterally, which receives the discharge from one or more fixture drains and connects to the main drain.

(28) "Horizontal Pipe" means any pipe or fitting which makes an angle of not more than 45 degrees with the horizontal.

(29) "Individual Vent" means a pipe installed to vent a fixture drain.

(30) "Inlet Coupling" means the terminal end of the water system to which the water service connection is attached. It may be a swivel fitting or threaded pipe end.

(31) "Main" means the principal artery of the system to which branches may be connected.

(32) "Main Drain" means the lowest pipe of a drainage system which receives sewage from all the fixtures within a mobile home and conducts these wastes to the drain outlet.

(33) "Main Vent" means the principal artery of the venting system to which vent branches may be connected.

(34) "Offset" means a combination of pipe and/or fittings that brings one section of the pipe out of line but into a line parallel with the other section.

(35) "Pitch." See Grade.

(36) "Plumbing Fixtures" means receptacles, devices, or appliances which are supplied with water or which receive liquid or liquid-borne wastes for discharge into the drainage system.

(37) "Plumbing System" means the water supply and distribution pipes; plumbing fixtures, faucets and traps; soil, waste and vent pipes; and water-treating or water-using equipment.

(38) "Primary Vent." See Main Vent.

(39) "Relief Vent" means an auxiliary vent which permits additional circulation of air in or between drainage and vent systems.

(40) "Secondary Vent" means any vent other than the main vent or those serving each toilet.

(41) "Sewage" means any liquid waste containing animal or vegetable matter in suspension or solution, and may include liquids containing chemicals in solution.

(42) "Siphonage" means the loss of water seal from fixture traps resulting from partial vacuum in the drainage system which may be of either of the following two types, or a combination of the two: (a.) Self-siphonage resulting from vacuum in a fixture drain generated solely by the discharge of the fixture served by that drain, or, (b). Induced siphonage resulting from vacuum in the drainage system generated by the discharge of one or more fixtures other than the one under observation.

(43) "Toilet Drain" means that part of the drainage piping which receives the discharge from each individual toilet.

(44) "Trap" means a fitting or device designed and constructed to provide a liquid seal that will prevent the back passage of air without materially affecting the flow of liquid waste through it.

(45) "Trap Arm" means the portion of a fixture drain between a trap and its vent.

(46) "Trap Seal" means the vertical depth of liquid that a trap will retain.

(47) "Vacuum Breaker." See Backflow Preventer.

(48) "Vent Cap" means the device or fitting which protects the vent pipe from foreign substance with an opening to the atmosphere equal to the area of the vent it serves.

(49) "Vent System" means that part of a piping installation which provides circulation of air within a drainage system.

(50) "Vertical Pipe" means any pipe or fitting which makes an angle of not more than 45 degrees with the vertical.

(51) "Water Connection" means the fitting or point of connection for the mobile home water distribution system designed for connection to a water supply.

(52) "Water Connector" means the removable extension connecting the mobile home water distribution system to the water supply.

(53) "Water Distribution System" means potable water piping within or permanently attached to the mobile home.

(54) "Wet Vent" means a vent which also serves as a drain for one or more fixtures.

(55) "Wet Vented Drainage System" means the specially designed system of drain piping that also vents one or more plumbing fixtures by means of a common waste and vent pipe.

**§ 280.603 General requirements.**

(a) *Minimum requirements.* Any plumbing system installed in a mobile home shall conform, at least, with the provisions of this subpart.

(1) *General.* The plumbing system shall be of durable material, free from defective workmanship, and so designed and constructed as to give satisfactory service for a reasonable life expectancy.

(2) *Conservation.* Water closets shall be selected and adjusted to use the minimum quantity of water consistent with proper performance and cleaning.

(3) *Connection to drainage system.* All plumbing, fixtures, drains, appurtenances, and appliances designed or used to receive or discharge liquid waste or sewage shall be connected to the mobile home drainage system in a manner provided by this standard.

(4) *Workmanship.* All design, construction, and workmanship shall be in conformance with accepted engineering practices and shall be of such character as to secure the results sought to be obtained by this standard.

(5) *Components.* Plumbing materials, devices, fixtures, fittings, equipment, appliances, and accessories intended for use in or attached to a mobile home, and not shown in the Table in § 280.604, shall be listed or certified by an approved listing agency, or be specifically approved by the Department when listing by an approved listing agency is not available.

(6) *Prohibited fittings and practices.* (i) Drainage or vent piping shall not be drilled and tapped for the purpose of making connections. (ii) Except as specifically provided elsewhere in this standard, vent pipes shall not be used as waste or drain pipes. (iii) Fittings, connections, devices, or methods of installation that obstruct or retard the flow of sewage, or air in the drainage or venting systems in an amount greater than

the normal frictional resistance to flow shall not be used unless their use is acceptable in this standard or their use is accepted as having a desirable and acceptable function of ultimate benefit to the proper and continued functioning of the plumbing system. (iv) Cracks, holes, or other imperfections in materials shall not be concealed by welding, brazing, or soldering or by paint, wax, tar, or other leak-sealing or repairing agents. (v) Piping, fixtures or equipment shall be located so as not to interfere with the normal use or with the normal operation and use of windows, doors or other required facilities. (vi) Galvanized pipe shall not be bent or welded.

(7) *Alignment of fittings.* All valves, pipes, and fittings shall be installed in correct relationship to the direction of flow.

(b) *Protective requirements.* (1) Cutting structural members. Structural members shall not be unnecessarily or carelessly weakened by cutting or notching.

(2) *Exposed piping.* All piping, pipe threads, hangers, and support exposed to the weather, water, mud, and road hazard, and subject to damage therefrom, shall be painted, coated, wrapped, or otherwise protected from deterioration.

(3) *Road damage.* Pipes, supports, drains, outlets, or drain hoses shall not extend or protrude in a manner where they could be unduly subjected to damage during transit.

(4) *Freezing.* All piping and fixtures subject to freezing temperatures shall be insulated or protected to prevent freezing, under normal occupancy. The manufacturer shall provide: (i) Written installation instructions for the method(s) required for compliance to this section; (ii) a statement in his installation instructions that if heat tape is used it shall be listed for use with mobile homes; (iii) a receptacle outlet conveniently located for the use of a heat tape and in compliance with § 280.806(b).

(5) All piping, except the fixture trap, shall be designed to allow drainage.

(6) *Rodent resistance.* All exterior openings around piping and equipment shall be sealed to resist the entrance of rodents.

(7) Piping and electrical wiring shall not pass through the same holes in walls, floors or roofs. Plastic piping shall not be exposed to heat in excess of manufacturers recommendation or radiation from heat producing appliances.

**§ 280.604 Materials.**

(a) *Minimum standards.* Materials, fixtures, or devices used or entering into the construction of plumbing systems in any mobile home shall be free from defects and shall conform to approved standards or to applicable standards in the following Table.

(b) *Specific usage.* Each of the sections following the Table indicates specifically the type of material presently permitted for use in the various parts of the plumbing system.

| Materials | ANSI | ASTM | FS | Other standards |
|---|---|---|---|---|
| **Ferrous pipe and fittings** | | | | |
| Cast iron screwed fittings | B16.4—1971 | | | |
| Malleable iron screwed fittings | B16.3—1971 | | | |
| Special cast iron fittings | | | | IAPMO PS 5—1966 |
| Welded wrought iron pipe | B36.2—1969 | A72—1966 | | |
| Wrought steel and wrought iron pipe | B36.10—1970 | | | |
| Black and hot dipped zinc-coated (galvanized) welded and seamless steel pipe. | | A120—1972a | | |
| Welded and seamless steel pipe | B125.1—1972 | A53—1972a | | |
| Pipe threads (except dry-seal) | B2.1—1968 | | | |
| Cast iron soil piping and fittings | A112.5.1—1971 | A74—1972 | WW-P-401D—1969 | |
| **Nonferrous pipe and fittings** | | | | |
| Seamless copper, pipe, standard sizes | H26.1—1973 | B42—1972 | | |
| Wrought seamless copper and copper alloy tube | H23.4—1973 | B251—1971 | | |
| Seamless copper water tube | H23.1—1973 | B88—1972 | | |
| Copper drainage tube (DWV) | H23.6—1973 | B306—1973 | | |
| Wrought copper and bronze solder-joint pressure fittings | B16.22—1973 | | | |
| Wrought copper and wrought copper alloy solder-joint drainage fittings. | B16.29—1966 | | | |
| Cast brass solder-joint pressure fittings | B16.18—1972 | | | |
| Cast bronze solder-joint drainage fittings—DWV | B16.23—1969 | | | |
| Cast bronze fittings for flared copper tubes | B16.26—1967 | | | |
| Seamless red brass pipe, standard sizes | H27.1—1973 | B43—1972 | | |
| Cast bronze threaded fittings, 150 and 300 pound | B16.15—1971 | | | |
| **Plastic Pipe and Fittings** | | | | |
| ABS plastic drain, waste, and vent pipe and fittings | | D2661—1973 | L-P 322B—1973. | IAPMO PS 17-71 NSF 14—1970 |
| PVC plastic drain, waste, and vent pipe and fittings | | D2665—1973 | L-P-320B—1973. | IAPMO PS 17-69 NSF-14—1970 |
| Chlorinated poly (vinyl/chloride) (CPVC) plastic hot water distribution systems. | | D2846—1973 | | NSF-14—1970 |
| Polybutylene (PB) plastic pipe (SDR-PR) | | D2662—1973 | | |
| Polybutylene (PB) plastic hot water distribution systems | | D3309—1974 | | |
| **Miscellaneous** | | | | |
| Pipe nipples, threaded | | | WW-N-351B(1)—1970. | |
| Rubber gaskets for cast iron soil pipe fittings | | C564—1970 | | |
| Backflow prevention devices | A112.14.1—1975. | | | IAPMO PS 31—1971 |
| Valve, bronze, gate 125—150 and 200 pound | | | WW-V-54D—1971. | |
| Valve, cast iron gate, threaded and flanged | | | WW-V-58B—1971. | |
| Plumbing—fixture-setting compound | | | HH-C-536A—1954. | |
| Cast brass and tubing P-traps | | | | IAPMO PS 2—1966 |
| Relief valves and automatic gas shutoff devices for hot water supply systems. | Z21.22 [1]—1971. | | | |
| Solvent cement for ABS plastic pipe and fittings | | D2235—1973 | | NSF-14—1970 |
| Solvent cement for PVC plastic pipe and fittings | | D2564—1973 | | NSF-14—1970 |
| Anti-siphon trap vent device | | | | NSF-24 |
| Diversion tees and twin waste elbow | | | | IAPMO PS 9-66 |
| Flexible copper water connectors | | | | IAPMO PS 14—1971 |
| Dishwater drain airgaps | | | | IAPMO PS 23—1966 |
| Coated flexible metal gas connectors for exterior use | | | | IAPMO TSC 9—1972 |
| **Plumbing fixtures** | | | | |
| Plumbing fixtures for land use | | | WW-P-541D—1971 | |
| Vitreous china plumbing fixtures | A112.19.2—1973 | | | |
| Enameled cast iron plumbing | A112.19.1—1973 | | | |
| Porcelain enameled formed steel plumbing fixtures | | | | IAPMO TSC 22—1972 |
| Formed metal porcelain-enameled sanitaryware | | | | IAPMO PS 5—1967 |
| Plastic bathtub units | Z124.1—1974 | | | |
| Gel-coated glass-fiber reinforced polyester resin shower receptor and shower stall units. | Z124.2—1967 | | | |
| Stainless steel plumbing fixtures—residential use | | | | CS-243—1962 NSF-24—1972 |
| Drains for prefabricated and precast showers | | | | IAMPO PS 4—1966 NSF-24—1972 |
| Cultured marble lavatory | | | | IAMPO PS 18—1972; CMI-LS. 1-75 |
| Performance specifications and methods of test for safety glazing material used in buildings. | Z97.1—1972 | | | NSF-54-72 |

[1] With addenda.

**§ 280.605 Joints and connections.**

(a) *Tightness.* Joints and connections in the plumbing system shall be gastight and watertight for the pressures required under testing procedures.

(1) *Assembling of pipe.* All joints and connections shall be correctly assembled for tightness. Pipe threads shall be fully engaged with the threads of the fitting. Plastic pipe and copper tubing shall be inserted to the full depth of the solder cup or welding sockets of each fitting. Pipe threads and slip joints shall not be wrapped with string, paper, putty, or similar fillers.

(2) *Threaded joints.* Threads for screw pipe and fittings shall conform to the approved or listed standard. Pipe ends shall be reamed out to size of bore. All burrs, chips, cutting oil and foreign matter shall be removed. Pipe joint cement or thread lubricant shall be of approved type and applied to male threads only.

(3) *Solder joints.* Solder joints for tubing shall be made with approved or listed solder type fittings. Surfaces to be soldered shall be cleaned bright. The joints shall be properly fluxed with noncorrosive paste type flux and made with approved or listed 50–50 solder or an approved solder having a higher melting temperature.

(4) *Plastic pipe, fittings and joints.* Plastic pipe and fittings shall be joined by installation methods recommended by the manufacturer or in accordance with the provisions of a recognized, approved, or listed standard.

(5) *Union joints.* Metal unions in water piping shall have metal-to-metal ground seats.

(6) *Flared joints.* Flared joints for soft-copper water tubing shall be made with approved or listed fittings. The tubing shall be expanded with a proper flaring tool.

(7) *Cast iron soil pipe joints.* Approved or listed cast iron pipe may be joined as follows: (i) Approved or listed hubless pipe as per the manufacturer's recommendation. (ii) Hub and plain-end soil pipe may be joined by compression fittings per the manufacturer's recommendation.

**§ 280.606 Traps and cleanouts.**

(a) *Traps*—(1) *Traps required.* Each plumbing fixture, except listed toilets, shall be separately trapped by approved water seal "P" traps. All traps shall be effectively vented.

(2) *Dual fixtures.* A two-compartment sink, two single sinks, two lavatories, or a single sink and a single lavatory with waste outlets not more than 30 inches apart and in the same room and flood level rims at the same level may be connected to one "P" trap and may be considered as a single fixture for the purpose of drainage and vent requirements.

(3) *Prohibited traps.* A trap which depends for its seal upon concealed interior partitions shall not be used. Full "S" traps, bell traps, drum traps, crown-vented traps, and running traps are prohibited. Fixtures shall not be double-trapped.

(4) *Material and design.* Each trap shall be self-cleaning with a smooth and uniform interior waterway. Traps shall be manufactured of cast iron, cast brass, or drawn brass tubing of not less than No. 20 Brown and Sharpe gage, or approved or listed plastic, or other approved or listed material. Union joints for a trap shall be beaded to provide a shoulder for the union nut. Each trap shall have the manufacturer's name stamped or cast in the body of the trap, and each tubing trap shall show the gage of the tubing.

(5) *Trap seal.* Each "P" trap shall have a water seal of not less than 2 inches and not more than 4 inches and shall be set true to its seal.

(6) *Size.* Traps shall be not less than 1¼ inches in diameter. A trap shall not be larger than the waste pipe to which it is connected.

(7) *Location.* Each trap shall be located as close to its vent and to its fixture outlet as structural conditions will permit.

(8) *Length of tailpiece.* The vertical distance from a trap to the fixture outlet shall not exceed 24 inches.

(9) *Installation.* (i) *Grade of trap arm.* The piping between a "P" trap and the fixture tee or the vented waste line shall be graded ¼ inch per foot towards the vent and in no event shall have a slope greater than its diameter. The vent opening at fixture tees shall not be below the weir of the "P" trap outlet. (ii) *Trap arm offset.* The piping between the "P" trap and vent may change direction or be offset horizontally with the equivalent of no more than 180 degrees total change in direction with a maximum of 90 degrees by any one fitting. (iii) *Concealed traps.* Traps with mechanical joints shall be accessible for repair and inspection. (iv) *Removability of Traps, Etc.* Traps shall be designed and installed so the "U" bend is removable without removing the strainers from the fixture. Continuous waste and tail pieces which are permanently attached to the "U" bend shall also be removable without removing the strainer from the fixture.

(b) *Cleanout openings*—(1) *Location of cleanout fittings.* (i) Cleanouts shall be installed if the drainage system cannot be cleaned through fixtures, drains, or vents. Cleanouts shall also be provided when fittings of more than 45 degrees are used to affect an offset except where long turn ells are used which provide sufficient "sweep" for cleaning. (ii) A full size cleanout shall be installed at the upper end of any section of drain piping which does not have the required minimum slope of ¼ inch per foot grade. (iii) A cleaning tool shall not be required to pass through more than 360 degrees of fittings, excluding removable "P" traps, to reach any part of the drainage system.

(2) *Access to cleanouts.* Cleanouts shall be accessible through an unobstructed minimum clearance of 12 inches directly in front of the opening. Each cleanout fitting shall open in a direction opposite to the flow or at right angles to the pipe. Concealed cleanouts that are not provided with access covers shall be extended to a point above the floor or outside of the mobile home, with pipe and fittings installed, as required, for drainage piping without sags and pockets.

(3) *Material.* Plugs and caps shall be brass or approved or listed plastic, with screw pipe threads.

(4) *Design.* Cleanout plugs shall have raised heads except that plugs at floor level shall have counter-sunk slots.

**§ 280.607 Plumbing fixtures.**

(a) *General requirements*—(1) *Quality of fixtures.* Plumbing fixtures shall have smooth impervious surfaces, be free from defects and concealed fouling surfaces, be capable of resisting road shock and vibration, and shall conform in quality and design to listed standards. Fixtures shall be permanently marked with the manufacturer's name.

(2) *Strainers.* The waste outlet of all plumbing fixtures, other than toilets, shall be equipped with a drain fitting that will provide an adequate unobstructed waterway.

(3) *Fixture connections.* Fixture tailpieces and continuous wastes in exposed or accessible locations shall be not less than No. 20 Brown and Sharpe gage seamless drawn-brass tubing or other approved pipe or tubing materials. Inaccessible fixture connections shall be constructed according to the requirements for drainage piping. Each fixture tailpiece, continuous waste, or waste and overflow shall be not less than 1½ inches for sinks of two or more compartments, dishwashers, clothes washing machines, laundry tubs, bath tubs, and not less than 1¼ inches for lavatories and single compartment sinks having a 2 inch maximum drain opening.

(4) *Concealed connections.* Concealed slip joint connections shall be provided with adequately sized unobstructed access panels and shall be accessible for inspection and repair.

(5) *Directional fitting.* An approved or listed "Y" or other directional-type branch fitting shall be installed in every tailpiece or continuous waste that receives the discharge from food waste disposal units, dishwashing, or other forced-discharge fixture or appliance. (See also § 280.607(b) (4) (ii))

(b) *Fixtures.* (1) *Spacing.* All plumbing fixtures shall be so installed with regard to spacing as to be reasonably accessible for their intended use.

(2) *Toilets.* (i) Toilets shall be designed and manufactured according to approved or listed standards and shall be equipped with a water flushing device capable of adequately flushing and cleaning the bowl at each operation of the flushing mechanism. (ii) Toilet flushing devices shall be designed to replace the water seal in the bowl after each operation. Flush valves, flushometer valves, and ball cocks shall operate automatically to shut off at the end of each flush or when the tank is filled to operating capacity. (iii) Flush tanks shall be fitted with an overflow pipe large enough to prevent flooding at the maximum flow rate of the ball cock. Overflow pipes shall discharge into the toilet, through the tank. (iv) Toilets

that have fouling surfaces that are not thoroughly washed at each discharge shall be prohibited. Any toilet that might permit the contents of the bowl to be siphoned back into the water system shall be prohibited. (v) Floor connection. Toilets shall be securely bolted to an approved flange or other approved fitting which is secured to the floor by means of corrosion-resistant screws. The bolts shall be of solid brass or other corrosion-resistant material and shall be not less than ¼ inch in diameter. A watertight seal shall be made between the toilet and flange or other approved fitting by use of a gasket or sealing compound.

(3) *Shower compartment.* (i) Each compartment stall shall be provided with an approved watertight receptor with sides and back extending at least 1 inch above the finished dam or threshold. In no case shall the depth of a shower receptor be less than 2 inches or more than 9 inches measured from the top of the finished dam or threshold to the top of the drain. The wall area shall be constructed of smooth, noncorrosive, and nonabsorbent waterproof materials to a height not less than 6 feet above the bathroom floor level. Such walls shall form a watertight joint with each other and with the bathtub, receptor or shower floor. The floor of the compartment shall slope uniformly to the drain at not less than one-fourth nor more than one-half inch per foot. (ii) The joint around the drain connection shall be made watertight by a flange, clamping ring, or other approved listed means. (iii) Shower doors and tub and shower enclosures shall be constructed so as to be waterproof and, if glazed, glazing shall comply with the Standard for Transparent Safety Glazing Material used in Buildings (ANSI Z97.1–1972). (iv) Prefabricated plumbing fixtures shall be approved or listed.

(4) *Dishwashing machines.* (i) Dishwashing machine shall not be directly connected to any waste piping, but shall discharge its waste through a fixed air gap installed above the machine. The drain connection from the air gap may connect to an individual trap, to a directional fitting installed in the sink tailpiece, or to the opening provided on the inlet side of a food waste disposal unit. (ii) Drain from a dishwashing machine shall not be connected to a sink tailpiece, continuous waste line, or trap on the discharge side of a food waste disposal unit.

(5) *Clothes washing machines.* (i) Clothes washing machines shall drain either into a properly vented trap, into a laundry tub tailpiece with watertight connections, into an open standpipe receptor, or over the rim of a laundry tub. (ii) Standpipes shall be 1½ inches minimum nominal iron pipe size, 1½ inches diameter nominal brass tubing not less than No. 20 Brown and Sharpe gage, or 1½ inches approved plastic materials. Receptors shall discharge into a vented trap or shall be connected to a laundry tub tailpiece by means of an approved or listed directional fitting. Each standpipe shall extend not less than 18 inches or more than 30 inches above its trap and shall terminate in an accessible location no lower than the top of clothes washing machine. A removable tightfitting cap or plug shall be installed on the standpipe when clothes washer is not provided. (iii) Clothes washing machine drain shall not be connected to the tailpiece, continuous waste, or trap of any sink or dishwashing machine.

(c) *Installation.* (1) *Access.* Each plumbing fixture and standpipe receptor shall be located and installed in a manner to be accessible for usage, cleaning, repair and replacement.

(2) *Alignment.* Fixtures shall be set level and in true alignment with adjacent walls. Where practical, piping from fixtures shall extend to nearest wall.

(3) *Brackets.* Wall-hung fixtures shall be rigidly attached to walls by metal brackets or supports without any strain being transmitted to the piping connections. Flush tanks shall be securely fastened to toilets or to the wall with corrosive-resistant materials.

(4) *Tub supports.* Bathtub rims at wall shall be supported on meal hangers or on end-grain wood blocking attached to the wall unless otherwise recommended by the manufacturer of the tub.

**§ 280.608 Hangers and supports.**

(a) *Strains and stresses.* Piping in a plumbing system shall be installed without undue strains and stresses, and provision shall be made for expansion, contraction, and structural settlement.

(b) *Piping supports.* Piping shall be secured at sufficiently close intervals to keep the pipe in alignment and carry the weight of the pipe and contents. Unless otherwise stated in the standards for specific materials shown in the Table in § 280.604(a), or unless specified by the pipe manufacturer, plastic drainage piping shall be supported at intervals not to exceed 4 feet and plastic water piping shall be supported at intervals not to exceed 3 feet.

(c) *Hangers and anchors.* (1) Hangers and anchors shall be of sufficient strength to support their proportional share of the pipe alignments and prevent rattling.

(2) Piping shall be securely attached to the structure by hangers, clamps, or brackets which provide protection against motion, vibration, road shock, or torque in the chassis.

(3) Hangers and straps supporting plastic pipe shall not compress, distort, cut or abrade the piping and shall allow free movement of the pipe.

**§ 280.609 Water distribution system.**

(a) *Water supply.* (1) *Supply piping.* Piping systems shall be sized to provide an adequate quantity of water to each plumbing fixture at a flow rate sufficient to keep the fixture in a clean and sanitary condition without any danger of backflow or siphonage (See Table in § 280.609(f)(1)). The manufacturer shall include in his written installation instructions that the mobile home has been designed for an inlet water pressure of 80 psi, and a statement that when the mobile home is to be installed in areas where the water pressure exceeds 80 psi, a pressure reducing valve should be installed.

(2) *Hot water supply.* Each mobile home equipped with a kitchen sink, and bathtub and/or shower shall be provided with a hot water supply system including a listed water heater.

(b) *Water outlets and supply connections.* (1) *Water connection.* Each mobile home with a water distribution system shall be equipped with a ¾-inch threaded inlet connection located within the rear half of the length of the mobile home. This connection shall be tagged or marked "Fresh Water Connection" (or "Fresh Water Fill"). A matching cap or plug shall be provided to seal the water inlet when it is not in use, and shall be permanently attached to the mobile home or water supply piping. When a master cold water shutoff full flow valve is not installed on the main feeder line in an accessible location, the manufacturer's installation instructions shall indicate that such a valve is to be installed in the water supply line adjacent to the home. When a mobile home includes expandable rooms or is composed of two or more units, fittings or connectors designed for such purpose shall be provided to connect any water piping. When not connected, the water piping shall be protected by means of matching threaded caps or plugs.

(2) *Prohibited connections.* (i) The installation of potable water supply piping or fixture or appliance connections shall be made in a manner to preclude the possibility of backflow. (ii) No part of the water system shall be connected to any drainage or vent piping.

(3) *Rim outlets.* The outlets of faucets, spouts, and similar devices shall be spaced at least 1 inch above the flood level of the fixture.

(4) *Appliance connections.* Water supplies connected to clothes washing or dishwashing machines shall be protected by an approved or listed fixed air gap provided within the appliance by the manufacturer.

(5) *Flushometer valves or manually operated flush valves.* An approved or listed vacuum breaker shall be installed and maintained in the water supply line on the discharge side of a toilet flushometer valve or manually operated flush valve. Vacuum breakers shall have a minimum clearance of 6 inches above the flood level of the fixture to the critical level mark unless otherwise permitted in their approval.

(6) *Flush tanks.* Toilet flush tanks shall be equipped with an approved or listed anti-siphon ball cock which shall be installed and maintained with its outlet or critical level mark not less than 1 inch above the full opening of the overflow pipe.

(c) *Water heater safety devices.* (1) *Relief valves.* (i) All water heaters shall be installed with approved and listed fully automatic valve or valves designed to provide temperature and pressure relief. (ii) Any temperature relief valve or combined pressure and temperature relief valve installed for this purpose shall have the temperature sensing element

immersed in the hottest water within the upper 6 inches of the tank. It shall be set to start relieving at a pressure of 150 psi or the rated working pressure of the tank whichever is lower and at or below a water temperature of 210° F. (iii) Relief valves shall be provided with full-sized drains, with cross sectional areas equivalent to that of the relief valve outlet, which shall be directed downward and discharge beneath the mobile home. Drain lines shall be of a material listed for hot water distribution and shall drain fully by gravity, shall not be trapped, and shall not have their outlets threaded, and the end of the drain shall be visible for inspection.

(d) *Materials.* (1) Piping material. Water pipe shall be of standard weight brass, galvanized wrought iron, galvanized steel, Type K, L or M copper tubing, approved or listed plastic or other approved or listed material. (i) Plastic Piping. All plastic water piping and fittings in mobile homes must be approved or listed for use with hot water.

(2) *Fittings.* Appropriate fittings shall be used for all changes in size and where pipes are joined. The material and design of fittings shall conform to the type of piping used. Special consideration shall be given to prevent corrosion when dissimilar metals are joined. (i) Fittings for screw piping shall be standard weight galvanized iron for galvanized iron and steel pipe, and of brass for brass piping. They shall be installed where required for change in direction, reduction of size, or where pipes are joined together. (ii) Fittings for copper tubing shall be cast brass or drawn copper (sweat-soldered) or shall be approved or listed fittings for the purpose intended.

(3) *Prohibited material.* Used piping materials shall not be permitted. Those pipe dopes, solder fluxes, oils, solvents, chemicals, or other substances that are toxic, corrosive, or otherwise detrimental to the water system shall not be used.

(e) *Installation of piping.* (1) *Minimum requirement.* All piping equipment, appurtenances, and devices shall be installed in workmanlike manner and shall conform with the provisions and intent of this standard.

(2) *Screw pipe.* Iron pipe-size brass or galvanized iron or steel pipe fittings shall be joined with approved or listed standard pipe threads fully engaged in the fittings. Pipe ends shall be reamed to the full bore of the pipe. Pipe-joint compound shall be insoluble in water, shall be nontoxic and shall be applied to male threads only.

(3) *Solder fittings.* Joints in copper water tube shall be made by the appropriate use of approved cast brass or wrought copper fittings, properly soldered together. The surface to be soldered shall be thoroughly cleaned bright mechanically. The joints shall be properly fluxed and made with approved solder.

(4) *Flared fittings.* A flaring tool shall be used to shape the ends of flared tubing to match the flare of fittings.

(5) *Plastic pipe and fittings.* Plastic pipe and fittings shall be joined by installation methods recommended by the manufacturer or in accordance with provisions of a listed standard.

(f) *Size of water supply piping*—(1) *Minimum size.* The size of water supply piping and branch lines shall not be less than sizes shown in the following Table:

*Minimum size tubing and pipe for water distribution systems*

| Number of fixtures | Tubing (nominal) | | Pipe iron pipe size (inches) |
|---|---|---|---|
| | Diameter (inches) | Outer diameter (inches) | |
| 1 | *¼ | ⅜ | ⅜ |
| 2 | ⅜ | ½ | ½ |
| 3 | ½ | ½ | ½ |
| 4 | ½ | ½ | ½ |
| 5 or more | ¾ | ⅞ | ¾ |

* 6 ft maximum length.

*Exceptions to table:* ⅜ inch nominal diameter or ½ inch OD minimum size for clothes washing or dishwashing machines, unless larger size is recommended by the fixture manufacturer. ½ inch nominal diameter or ⅝ inch OD minimum size for flushometer or metering type valves unless otherwise specified in their listing. No galvanized screw piping shall be less than ½ inch iron pipe size.

(2) *Sizing procedure.* Both hot and cold water piping systems shall be computed by the following method: (i) *Size of branch.* Start at the most remote outlet on any branch of the hot or cold water piping and progressively count towards the water service connection, computing the total number of fixtures supplied along each section of piping. Where branches are joined together, the number of fixtures on each branch shall be totalled so that no fixture is counted twice. Following down the left-hand column of the preceding Table a corresponding number of fixtures will be found. The required pipe or tubing size is indicated in the other columns on the same line. (ii) A water heater, food waste disposal unit, evaporative cooler or ice maker shall not be counted as a water-using fixture when computing pipe sizes.

(g) *Line valves.* Valves, when installed in the water supply distribution system (except those immediately controlling one fixture supply) and when fully opened, shall have a cross-sectional area of the smallest orifice or opening, through which the water flows, at least equal to the cross-sectional area of the nominal size of the pipe in which the valve is installed.

**§ 280.610 Drainage systems.**

(a) *General.* (1) Each fixture directly connected to the drainage system shall be installed with a water seal trap (§ 280.606(a)).

(2) The drainage system shall be designed to provide an adequate circulation of air in all piping with no danger of siphonage, aspiration, or forcing of trap seals under conditions of ordinary use.

(b) *Materials*—(1) *Pipe.* Drainage piping shall be standard weight steel, wrought iron, brass, copper tube DWV, listed plastic, cast iron, or other listed or approved materials.

(2) *Fittings.* Drainage fittings shall be recessed drainage pattern with smooth interior waterways of the same diameter as the piping and shall be of a material conforming to the type of piping used. Drainage fittings shall be designed to provide for a ¼ inch per foot grade in horizontal piping. (i) Fittings for screw pipe shall be cast iron, malleable iron, brass, or listed plastic with standard pipe threads. (ii) Fittings for copper tubing shall be cast brass or wrought copper. (iii) Socket-type fittings for plastic piping shall comply with listed standards. (iv) Brass or bronze adaptor or wrought copper fittings shall be used to join copper tubing to threaded pipe.

(c) *Drain outlets*—(1) *Location of drain.* Each mobile home shall have only one drain outlet which shall terminate in the rear half section.

(2) *Clearance from drain outlet.* The drain outlet shall be provided with a minimum clearance of 3 inches in any direction from all parts of the structure or appurtenances and with not less than 18 inches unrestricted clearance directly in front of the drain outlet.

(3) *Drain connector.* The drain connector shall not be smaller than the piping to which it is connected and shall be equipped with a water-tight cap or plug matching the drain outlet. The cap or plug shall be permanently attached to the mobile home or drain outlet.

(4) The drain outlet and drain connector shall not be less than 3 inches inside diameter.

(5) Preassembly of drain lines. Drain lines, provided by the manufacturer, located under the mobile home, designed to bring the drain system to one distribution point and which may be damaged in transit, must be designed for proper site assembly.

(d) *Fixture connections.* Drainage piping shall be provided with approved or listed inlet fittings for fixture connections, correctly located according to the size and type of fixture to be connected.

(1) *Toilet connection.* The drain connection for each toilet shall be 3 inches minimum inside diameter and shall be fitted with an iron, brass, or listed plastic floor flange adaptor ring securely screwed, soldered or otherwise permanently attached to the drain piping in an approved manner and securely fastened to the floor.

(e) *Size of drainage piping*—(1) *Fixture load.* Except as provided by § 280.611 (d)(2), drain pipe sizes shall be determined by the type of fixture and the total number connected to each drain. (i) A 1½ inch minimum diameter piping shall be required for one and not more than three individually vented fixtures. (ii) A 2-inch minimum diameter piping shall be required for four or more fixtures individually vented. (iii) A 3-inch minimum diameter piping shall be required for toilets.

(f) *Wet-vented drainage system.* Plumbing fixture traps may connect into a wet-vented drainage system which shall be designed and installed to accom-

modate the passage of air and waste in the same pipe.

(1) *Horizontal piping.* All parts of a wet-vented drainage system, including the connected fixture drains, shall be horizontal except for wet-vented vertical risers which shall terminate with a 1½ inch minimum diameter continuous vent. Where required by structural design, wet-vented drain piping may be offset vertically when other vented fixture drains or relief vents are connected to the drain piping at or below the vertical offsets.

(2) *Size.* A wet-vented drain pipe shall be 2 inches minimum diameter and at least one pipe size larger than the largest connected trap or fixture drain. Not more than three fixtures may connect to a 2-inch diameter wet-vented drain system.

(3) *Length of trap arm.* Fixture traps shall be located within the distance given in § 280.611(c)(5). Not more than one trap shall connect to a trap arm.

(g) *Offsets and branch fittings*—(1) *Changes in direction.* Changes in direction of drainage piping shall be made by the appropriate use of approved or listed fittings, and shall be of the following angles: 11¼, 22½, 45, 60, or 90 degrees; or other approved or listed fittings or combination of fittings with equivalent radius or sweep.

(2) *Horizontal to vertical.* Horizontal drainage lines, connecting with a vertical pipe shall enter through 45-degree "Y" branches, 60-degree "Y" branches, long-turn "TY" branches, sanitary "T" branches, or other approved or listed fittings or combination of fittings having equivalent sweep. Fittings having more than one branch at the same level shall not be used, unless the fitting is constructed so that the discharge from any one branch cannot readily enter any other branch. However, a double sanitary "T" may be used when the drain line is increased not less than two pipe sizes.

(3) *Horizontal to horizontal and vertical to horizontal.* Horizontal drainage lines connecting with other horizontal drainage lines or vertical drainage lines connected with horizontal drainage lines shall enter through 45-degree "Y" branches, long-turn "TY" branches, or other approved or listed fittings or combination of fittings having equivalent sweep.

(h) Grade of Horizontal Drainage Piping. Except for fixture connections on the inlet side of the trap, horizontal drainage piping shall be run in practical alignment and have a uniform grade of not less than ¼ inch per foot toward the mobile home drain outlet. Where it is impractical, due to the structural features or arrangement of any mobile home, to obtain a grade of ¼ inch per foot, the pipe or piping may have a grade of not less than ⅛ inch per foot, when a full size cleanout is installed at the upper end.

**§ 280.611 Vents and venting.**

(a) *General.* Each plumbing fixture trap shall be protected against siphonage and back pressure, and air circulation shall be ensured throughout all parts of the drainage system by means of vents installed in accordance with the requirements of this section and as otherwise required by this standard.

(b) *Materials*—(1) *Pipe.* Vent piping shall be standard weight steel, wrought iron, brass, copper tube DWV, listed plastic, cast iron or other approved or listed materials.

(2) *Fittings.* Appropriate fittings shall be used for all changes in direction or size and where pipes are joined. The material and design of vent fittings shall conform to the type of piping used. (i) Fittings for screw pipe shall be cast iron, malleable iron, plastic, or brass, with standard pipe threads. (ii) Fittings for copper tubing shall be cast brass or wrought copper. (iii) Fittings for plastic piping shall be made to approved applicable standards. (iv) Brass adaptor fittings or wrought copper shall be used to join copper tubing to threaded pipe. (v) Listed rectangular tubing may be used for vent piping only providing it has an open cross section at least equal to the circular vent pipe required. Listed transition fittings shall be used.

(c) *Size of vent piping*—(1) *Main vent.* The drain piping for each toilet shall be vented by a 1½ inch minimum diameter vent or rectangular vent of venting cross section equivalent to or greater than the venting cross section of a 1½ inch diameter vent, connected to the main drain by one of the following methods: (i) A 1½ inch diameter (min.) individual vent pipe or equivalent directly connected to the toilet drain within the distance allowed in § 280.611(c)(5), for 3-inch trap arms undiminished in size through the roof, (ii) A 1½ inch diameter (min.) continuous vent, or equivalent, indirectly connected to the toilet drain piping through a 2-inch wet-vented drain that carries the waste of not more than one fixture, or, (iii) Two or more vented drains when at least one is wet-vented, or 2-inch diameter (minimum), and each drain is separately connected to the main drain. At least one of the drains shall connect downstream from the toilet within the distance allowed in § 280.611(c)(5) for 3-inch trap arms.

(2) *Individual Vents.* Each individually vented fixture with a 1½ inch or smaller trap shall be provided with a vent pipe equivalent in area to a 1¼ inch nominal pipe size. The main vent, toilet vent and relief vent, and the continuous vent of wet-vented systems shall have an area equivalent to 1½ inch nominal pipe size.

(3) *Common Vent.* When two fixture traps located within the distance allowed from their vent have their trap arms connected separately at the same level into an approved double fitting, an individual vent pipe may serve as a common vent without any increase in size.

(4) *Intersecting Vents.* Where two or more vent pipes are joined together, no increase in size shall be required; however, the largest vent pipe shall extend full size through the roof.

(5) Distance of fixture trap from vent shall not exceed the values given in the following Table:

*Maximum Distance of Fixtures From Vent Trap*

| *Size of fixture drain (inches)* | *Distance trap to vent* |
|---|---|
| 1¼ | 4 ft. 6 in. |
| 1½ | 4 ft 6 in. |
| 2 | 5 ft. |
| 3 | 6 ft. |

(d) *Anti-siphon trap vent.* An anti-siphon trap vent may be used as a secondary vent system for plumbing fixtures protected by traps not larger than 1½ inches, when installed in accordance with the manufacturers' recommendations and the following conditions: (i) Not more than two fixtures individually protected by the device shall be drained by a common 1½ inch drain. (ii) Minimum drain size for three or more fixtures individually protected by the device shall be 2 inches. (iii) A primary vent stack must be installed to vent the main drain at the point of heaviest drainage fixture unit loading. (iv) The device shall be installed in a location that permits a free flow of air and shall be accessible for inspection, maintenance, and replacement and the sealing function shall be at least 6 inches above the top of the trap arm. (v) Materials for the anti-siphon trap vent shall be as follows: cap and housing shall be listed acrylonitrile-butadiene styrene, DWV grade; stem shall be DWV grade nylon or acetal; spring shall be stainless steel wire, type 302; sealing disc shall be neoprene, conforming to ASTM C 564–70, or, silicone rubber, low and high temperature and tear resistant, conforming to F.S. ZZ–R–765B and MIL–L–10547.

(e) *Grade and connections*—(1) *Horizontal vents.* Each vent shall extend vertically from its fixture "T" or point of connection with the waste piping to a point not less than 6 inches above the extreme flood level of the fixture it is venting before offsetting horizontally or being connected with any other vent pipe. Vents for horizontal drains shall connect above the centerline of the drain piping ahead (downstream) of the trap. Where required by structural conditions, vent piping may offset below the rim of the fixture at the maximum angle or height possible.

(f) *Vent terminal.*—(1) *Roof extension.* Each vent pipe shall extend through its flashing and terminate vertically, undiminished in size, not less than 2 inches above the roof. Vent openings shall not be less than 3 feet away from any motor-driven air intake that opens into habitable areas.

(2) *Flashing.* The opening around each vent pipe shall be made watertight by an adequate flashing or flashing material.

(g) *Vent caps.* Vent caps, if provided, shall be of the removable type (without removing the flashing from the roof). When vent caps are used for roof space ventilation and the caps are identical to vent caps used for the plumbing system,

plumbing system caps shall be identified with permanent markings.

§ 280.612 Test and inspection.

(a) *Water system.* All water piping in the water distribution system shall be subjected to a pressure test. The test shall be made by subjecting the system to air or water at 10 psi for 15 minutes without loss of pressure.

(b) *Drainage and vent system and plumbing fixtures.* The waste and vent system shall be tested by one of the three following alternate methods for evidence or indication of leakage:

(1) *Water test.* Before plumbing fixtures are connected, all of the openings into the piping shall be plugged and the entire piping system subjected to a static water test for 15 minutes by filling it with water to the top of the highest vent opening. There shall be no evidence of leakage.

(2) *Air test.* After all fixtures have been installed, the traps filled with water, and the remaining openings securely plugged, the entire system shall be subjected to a 2-inch (manometer) water column air pressure test. If the system loses pressure, leaks may be located with smoke pumped into the system, or with soap suds spread on the exterior of the piping (Bubble test).

(3) *Flood level test.* The mobile home shall be in a level position, all fixtures shall be connected, and the entire system shall be filled with water to the rim of the toilet bowl. (Tub and shower drains shall be plugged). After all trapped air has been released, the test shall be sustained for not less than 15 minutes without evidence of leaks. Then the system shall be unplugged and emptied. The waste piping above the level of the toilet bowl shall then be tested and show no indication of leakage when the high fixtures are filled with water and emptied simultaneously to obtain the maximum possible flow in the drain piping.

(c) *Fixture test.* The plumbing fixtures and connections shall be subjected to a flow test by filling them with water and checking for leaks and retarded flow while they are being emptied.

(d) *Shower compartments.* Shower compartments and receptors shall be tested for leaks prior to being covered by finish material. Each pan shall be filled with water to the top of the dam for not less than 15 minutes.

## Subpart H—Heating, Cooling and Fuel Burning Systems

§ 280.701 Scope.

Subpart H of this standard covers the heating, cooling and fuel burning equipment installed within, on, or external to a mobile home.

§ 280.702 Definitions.

(a) The definitions in this subpart apply to Subpart H only.

(1) "Accessible," when applied to a fixture, connection, appliance or equipment, means having access thereto, but which may require the removal of an access panel, door or similar obstruction.

(2) "Air Conditioner Blower Coil System" means a comfort cooling appliance where the condenser section is placed external to the mobile home and evaporator section with circulating blower attached to the mobile home air supply duct system. Provision must be made for a return air system to the evaporator/blower section. Refrigerant connection between the two parts of the system is accomplished by tubing.

(3) "Air Conditioner Split System" means a comfort cooling appliance where the condenser section is placed external to the mobile home and the evaporator section incorporated into the heating appliance or with a separate blower/coil section within the mobile home. Refrigerant connection between the two parts of the system is accomplished by tubing.

(4) "Air Conditioning Condenser Section" means that portion of a refrigerated air cooling or (in the case of a heat pump) heating system which includes the refrigerant pump (compressor) and the external heat exchanger.

(5) "Air Conditioning Evaporator Section" means a heat exchanger used to cool or (in the case of a heat pump) heat air for use in comfort cooling (or heating) the living space.

(6) "Air Conditioning Self Contained System" means a comfort cooling appliance combining the condenser section, evaporator and air circulating blower into one unit with connecting ducts for the supply and return air systems.

(7) "Air Duct" means conduits or passageways for conveying air to or from heating, cooling, air conditioning or ventilation equipment, but not including the plenum.

(8) "Automatic Pump (Oil Lifter)" means a pump, not an integral part of the oil-burning appliance, that automatically pumps oil from the supply tank and delivers the oil under a constant head to an oil-burning appliance.

(9) "Btu. British Thermal Units" means the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit.

(10) "Btuh" means British thermal units per hour.

(11) "Burner" means a device for the final conveyance of fuel or a mixture of fuel and air to the combustion zone.

(12) "Central Air Conditioning System" means either an air conditioning split system or an external combination heating/cooling system.

(13) "Class 0 Air Ducts" means ducts of materials and connectors having a fire-hazard classification of zero.

(14) "Class 1 Air Ducts" means ducts of materials and connectors having a flame-spread rating of not over 25 without evidence of continued progressive combustion and a smoke-developed rating of not over 50.

(15) "Class 2 Air Ducts" means ducts of materials and connectors having a flame-spread rating of not over 50 without evidence of continued progressive combustion and a smoke-developed rating of not over 50 for the inside surface and not over 100 for the outside surface.

(16) "Clearance" means the distance between the appliance, chimney, vent, chimney or vent connector or plenum and the nearest surface.

(17) "Connector—Gas Appliance" means a flexible or semi-rigid connector listed as conforming to ANSI Standard Z21.24, Metal Connectors for Gas Appliance, used to convey fuel gas, three feet or less in length (six feet or less for gas ranges), between a gas outlet and a gas appliance in the same room with the outlet.

(18) "Energy Efficiency Ratio (EER)" means the ratio of the cooling capacity output of an air conditioner for each unit of power input.

$$EER = \frac{\text{Capacity (Btuh)}}{\text{Power input (watts)}}$$

(19) "External Combination Heating/Cooling System" means a comfort conditioning system placed external to the mobile home with connecting ducts to the mobile home for the supply and return air systems.

(20) "Factory-Built Fireplace" means a hearth, fire chamber and chimney assembly composed of listed factory-built components assembled in accordance with the terms of listing to form a complete fireplace.

(21) "Fireplace Stove" means a chimney connected solid fuel-burning stove having part of its fire chamber open to the room.

(22) "Fuel Gas Piping System" means the arrangement of piping, tubing, fittings, connectors, valves and devices designed and intended to supply or control the flow of fuel gas to the appliance(s).

(23) "Fuel Oil Piping System" means the arrangement of piping, tubing, fittings, connectors, valves and devices designed and intended to supply or control the flow of fuel oil to the appliance(s).

(24) "Gas Clothes Dryer" means a device used to dry wet laundry by means of heat derived from the combustion of fuel gases.

(25) "Gas Refrigerator" means a gas-burning appliance which is designed to extract heat from a suitable chamber.

(26) "Gas Supply Connection" means the terminal end or connection to which a gas supply connector is attached.

(27) "Gas Supply Connector, Mobile Home" means a listed flexible connector designed for connecting the mobile home to the gas supply source.

(28) "Gas Vents" means factory-built vent piping and vent fittings listed by an approved testing agency, that are assembled and used in accordance with the terms of their listings, for conveying flue gases to the outside atmosphere. (i) "Type B Gas Vent" means a gas vent for venting gas appliances with draft hoods

and other gas appliances listed for use with Type B Gas Vents. (ii) "Type BW Gas Vent" means a gas vent for venting listed gas-fired vented wall furnaces.

(29) "Heat Producing Appliance" means all heating and cooking appliances and fuel burning appliances.

(30) "Heating Appliance" means an appliance for comfort heating or for domestic water heating.

(31) Liquefied Petroleum Gases." The terms "Liquefied petroleum gases," "LPG" and "LP-Gas" as used in this standard shall mean and include any material which is composed predominantly of any of the following hydrocarbons, or mixtures of them: propane, propylene butanes (normal butane or isobutane), and butylenes.

(32) "Plenum" means an air compartment which is part of an air-distributing system, to which one or more ducts or outlets are connected. (i) Furnace supply plenum is a plenum attached directly to, or an integral part of, the air supply outlet of the furnace. (ii) Furnace return plenum is a plenum attached directly to, or an integral part of, the return inlet of the furnace.

(33) "Quick-Disconnect Device" means a hand-operated device which provides a means for connecting and disconnecting a gas supply or connecting gas systems and which is equipped with an automatic means to shut off the gas supply when the device is disconnected.

(34) "Readily Accessible" means direct access without the necessity of removing any panel, door, or similar obstruction.

(35) "Roof Jack" means that portion of a mobile home heater flue or vent assembly, including the cap, insulating means, flashing, and ceiling plate, located in and above the roof of a mobile home.

(36) "Sealed Combustion System Appliance" means an appliance which by its inherent design is constructed so that all air supplied for combustion, the combustion system of the appliance, and all products of combustion are completely isolated from the atmosphere of the space in which it is installed.

(37) "Water Heater" means an appliance for heating water for domestic purposes other than for space heating.

**§ 280.703 Minimum standards.**

Heating, cooling and fuel burning appliances and systems in mobile homes shall be free of defects and shall conform to applicable standards in the following table unless otherwise specified in this standard. (See § 280.4).

| Type | ANSI | UL | Other standards |
|---|---|---|---|
| Appliances: | | | |
| Air conditioners, central cooling | | 465 | |
| Liquid fuel-burning heating appliances for mobile homes and travel trailers. | A147.1—1969 | 307(A)—1969 | |
| Electric Air Heater | | 1025 | |
| Electric Baseboard Heating Equipment | | 1042 | |
| Electric Central Air-Heating Equipment | 1096 | | |
| Gas-heating appliances for mobile homes and travel trailers. | | 307(b)—1965 | |
| Gas clothes dryers | Z21.5.1—1972 | | |
| | Z21.5.1a—1973 | | |
| | Z21.5.1b—1974 | | |
| Commercial gas-fired and electrically-heated hot water generating equipment. | | | NSF-5—1959 |
| Gas-fired absorption summer air conditioning appliances. | Z21.40.1—1973 | | |
| | Z21.40.1b—1974 | | |
| Gas-fired gravity and forced air central furnaces | Z21.47—1973 | | |
| | Z21.47a—1974 | | |
| Gas-fired gravity and fan-type sealed combustion system wall furnaces. | Z21.44—1973 | | |
| | Z21.44a—1974 | | |
| | Z21.44b—1975 | | |
| Commercial cooking and warming equipment | | | NSF-4—1967 |
| Household cooking gas appliances | Z21.1—1972 | | |
| | Z21.1a—1974 | | |
| Refrigerators using gas fuel | Z21.19—1971 | | |
| | Z21.19a—1972 | | |
| | Z21.19b—1973 | | |
| Automatic storage type water heaters with input less than 75,000 Btu/h. | Z21.10.1—1974 | | |
| | Z21.10.1a—1975 | | |
| Heating equipment, electric central air | | 1096 | |
| Heat pumps | | 559 | |
| Ferrous pipe and fittings: | | | |
| Black and hot dipped zinc-coated (galvanized) welded and seamless steel pipe for ordinary uses. | | | ASTM A120—1972a; WW-P-406D—1973 |
| Electric-resistance welded coiled steel tubing for gas and fuel oil lines. | | | ASTM A539—1973 |
| Pipe threads | B2.1—1968 | | |
| Wrought steel and wrought iron pipe | B36.10—1970 | | |
| Nonferrous pipe, tubing, and fittings: | | | |
| Seamless copper water tube | | | ASTM B88—1972 |
| Seamless copper tube for air conditioning and refrigeration field service. | | | ASTM B280—1973 |
| Metal connectors for gas appliances | Z21.24—1973 | | |
| Manually operated gas valves | Z21.15—1974 | | |
| Trailer standard for coated flexible metal gas connectors for exterior use. | | | IAPMO TSC 9—1972 |
| Wrought seamless copper and copper alloy tube | | | ASTM B251—1971 |
| Seamless copper pipe, standard size | | | ASTM B42—1972, WW-P-377D—1962 |
| Miscellaneous: | | | |
| Air ducts | | 181—1972 | |
| Flame tests of flame-resistant fabrics | | 214—1971 | |
| Tube fittings for flammable and combustible fluids and refrigeration service. | | 109—1972 | |
| LPG containers and accessories | | | ASME, DOT |
| Pigtails, expansion coils, and flexible hose connectors for liquified petroleum gas. | | 569—1973 | |
| Roof jacks for trailer coaches | | 311—1971 | |
| Relief valves and automatic gas shutoff devices for hot water supply systems. | Z21.22—1971 | | |
| | Z21.22a—1972 | | |
| | Z21.22b—1974 | | |
| Automatic gas ignition systems and components | Z21.20—1971 | | |
| | Z21.20a—1972 | | |
| | Z21.20b—1974 | | |
| Automatic valves for gas appliances | Z21.21—1974 | | |
| Gas appliance thermostats | A21.23—1971 | | |
| | Z21.23a—1972 | | |
| | Z21.23b—1974 | | |
| Gas vents | A131.2—1973 | 441—1973 | |
| Factory-built chimneys | A131.1—1971 | 103—1971 | |
| Factory-built fireplaces | A131.3—1971 | 127—1971 | GAL |
| Installation of oil burning equipment | A95.1—1974 | | NFPA No. 31—1974 |
| Installation of gas appliances, gas piping in buildings | Z223.1—1974 | | NFPA No. 54—1974 |
| Resident type warm air heating and air conditioning | | | NFPA No. 90B—1973 |
| Tests for flammability of plastic materials for parts in devices and appliances. | | 94—1974 | |
| Storage and handling of liquefied petroleum gas | A106.1—1974 | | NFPA No. 58—1974 |

**§ 280.704 Fuel supply systems.**

(a) *LP-Gas system design and service line pressure*—(1) Systems shall be of the vapor-withdrawal type.

(2) Gas, at a pressure not over 14 inches water column (½ psi), shall be delivered from the system into the gas supply connection.

(b) *LP-Gas Containers*—(1) *Maximum capacity.* No more than two containers having an individual water capacity of not more than 105 pounds (approximately 45 pounds LP-Gas capacity), shall be installed on or in a compartment of any mobile home.

(2) *Construction of containers.* Containers shall be constructed and marked in accordance with the specifications for LP-Gas Containers of the U.S. Department of Transportation (DOT) or the Rules for Construction of Unfired Pressure Vessels, Section VIII, Division 1, ASME Boiler and Pressure Vessel Code. ASME Containers shall have a design pressure of at least 312.5 psig. (i) Container supply systems shall be arranged for vapor withdrawal only. (ii) Container openings for vapor withdrawal shall be located in the vapor space when the container is in service or shall be provided with a suitable internal withdrawal tube which communicates with the vapor space in or near the highest point in the container when it is mounted in service position, with the vehicle on a level surface. Containers shall be permanently and legibly marked in a conspicuous manner on the outside to show the correct mounting position and the position of the service outlet connection. The method of mounting in place shall be such as to minimize the possibility of an incorrect positioning of the container.

(3) *Location of LP-Gas Containers and Systems.* (i) LP-Gas Containers shall not be installed, nor shall provisions be made for installing or storing any LP-Gas container, even temporarily, inside any mobile home except for listed, completely self-contained hand torches, lanterns, or similar equipment with containers having a maximum water capacity of not more than 2½ pounds (approximately one pound LP-Gas capacity). (ii) Containers, control valves, and regulating equipment, when installed, shall be mounted on the "A" frame of the mobile home, or installed in a compartment that is vaportight to the inside of the mobile home and accessible only from the outside. The compartment shall be ventilated at top and bottom to facilitate diffusion of vapors. The compartment shall be ventilated with two vents having an aggregate area of not less than two percent of the floor area of the compartment and shall open unrestricted to the outside atmosphere. The required vents shall be equally distributed between the floor and ceiling of the compartment. If the lower vent is located in the access door or wall, the bottom edge of the vent shall be flush with the floor level of the compartment. The top vent shall be located in the access door or wall with the bottom of the vent not more than 12 inches below the ceiling level of the compartment. All vents shall have an unrestricted discarge to the outside atmosphere. Access doors or panels of compartments shall not be equipped with locks or require special tools or knowledge to open. (iii) Permanent and removable fuel containers shall be securely mounted to prevent jarring loose, slipping or rotating and the fastenings shall be designed and constructed to withstand static loading in any direction equal to twice the weight of the tank and attachments when filled with fuel, using a safety factor of not less than four based on the ultimate strength of the material to be used.

(4) *LP-Gas Container Valves and Accessories.* (i) Valves in the assembly of a two-cylinder system shall be arranged so that replacement of containers can be made without shutting off the flow of gas to the appliance(s). This provision is not to be construed as requiring an automatic change-over device. (ii) Shutoff valves on the containers shall be protected as follows, in transit, in storage, and while being moved into final utilization by setting into a recess of the container to prevent possibility of their being struck if container is dropped upon a flat surface, or by ventilated cap or collar, fastened to the container, capable of withstanding a blow from any direction equivalent to that of a 30-pound weight dropped 4 feet. Construction shall be such that the blow will not be transmitted to the valve. (iv) Regulators shall be connected directly to the container shutoff valve outlets or mounted securely by means of a support bracket and connected to the container shutoff valve or valves with listed high pressure connections. If the container is permanently mounted the connector shall be as required above or with a listed semi-rigid tubing connector.

(5) *LP-Gas Safety Devices.* (i) DOT containers shall be provided with safety relief devices as required by the regulations of the U.S. Department of Transportation. ASME containers shall be provided with relief valves in accordance with Subsection 221 of the Standard for the Storage and Handling of Liquefied Petroleum Gases (NFPA No. 58–1974; ANSI Z106.1–1974). Safety relief valves shall have direct communication with the vapor space of the vessel. (ii) The delivery side of the gas pressure regulator shall be equipped with a safety relief device set to discharge at a pressure not less than two times and not more than three times the delivery pressure of the regulator. (iii) Systems mounted on the "A" frame assembly shall be so located that the discharge from the safety relief devices shall be into the open air and not less than three feet horizontally from any opening into the mobile home below the level of such discharge. (iv) Safety relief valves located within liquefied petroleum gas container compartments may be less than three feet from openings provided the bottom vent of the compartment is at the same level or lower than the bottom of any opening into the vehicle, or the compartment is not located on the same wall plane as the opening(s) and is at least two feet horizontally from such openings.

(6) *LP-Gas System Enclosure and Mounting.* (i) Housings and enclosures shall be designed to provide proper ventilation at least equivalent to that specified in § 280.704(b)(3)(ii). (ii) Doors, hoods, domes, or portions of housings and enclosures required to be removed or opened for replacement of containers shall incorporate means for clamping them firmly in place and preventing them from working loose during transit. (iii) Provisions shall be incorporated in the assembly to hold the containers firmly in position and prevent their movement during transit. (iv) Containers shall be mounted on a substantial support or a base secured firmly to the vehicle chassis. Neither the container nor its support shall extend below the mobile home frame.

(c) *Oil Tanks*—(1) *Installation.* Oil tanks and listed automatic pumps (oil lifters) installed for gravity flow of oil to heating equipment shall be installed so that the top of the tank is no higher than 8 feet above the appliance oil control and the bottom of the tank is not less than 18 inches above the appliance oil control.

(2) *Auxiliary Oil Storage Tank.* Oil supply tanks affixed to a mobile home shall be so located as to require filling and draining from the outside and shall be in a place readily available for inspection. If the fuel supply tank is located in a compartment of a mobile home, the compartment shall be ventilated at the bottom to permit diffusion of vapors and shall be insulated from the structural members of the body. Tanks so installed shall be provided with an outside fill and vent pipe and an approved liquid level gage.

(3) *Shutoff Valve.* A readily accessible, approved manual shutoff valve shall be installed at the outlet of an oil supply tank. The valve shall be installed to close against the supply.

(4) *Fuel Oil Filters.* All oil tanks shall be equipped with an approved oil filter or strainer located downstream from the tank shutoff valve. The fuel oil filter or strainer shall contain a sump with a drain for the entrapment of water.

**§ 280.705 Gas piping systems.**

(a) *General.* The requirements of this Section shall govern the installation of all fuel gas piping attached to any mobile home. The gas piping supply system shall be designed for a pressure not exceeding 14 inch water column (½ psi) and not less than 7 inch water column (¼ psi). The manufacturer shall indicate in his written installation instructions the design pressure limitations for safe and effective operation of the gas piping system. None of the requirements listed in this Section shall apply to the piping supplied as a part of an appliance. All exterior openings around piping, ducts, plenums or vents shall be sealed to resist the entrance of rodents.

(b) *Materials.* All materials used for the installation, extension, alteration, or repair of any gas piping system shall be new and free from defects or internal obstructions. It shall not be permissible

to repair defects in gas piping or fittings. Inferior or defective materials shall be removed and replaced with acceptable material. The system shall be made of materials having a melting point of not less than 1,450° F, except as provided in § 280.705(e). They shall consist of one or more of the materials described in § 280.705(b) (1) through (4).

(1) Steel or wrought-iron pipe shall comply with ANSI Standard B36.10–1970 for Wrought-Steel and Wrought-Iron Pipe. Threaded brass pipe in iron pipe sizes may be used. Threaded brass pipe shall comply with Standard Sizes and Specifications for Seamless Red Brass Pipe (ASTM B43–66).

(2) Fittings for gas piping shall be wrought iron, malleable iron, steel, or brass (containing not more than 75 percent copper).

(3) Copper tubing shall be annealed type, Grade K or L, conforming to the Specifications for Seamless Copper Water Tube (ASTM B88–72), or shall comply with the Specifications for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service, ASTM B280–73. When used on systems designed for natural gas, such tubing shall be internally tinned.

(4) Steel tubing shall have a minimum wall thickness of 0.032 inch for tubing of ½ inch diameter and smaller and 0.049 inch for diameters ½ inch and larger. Steel tubing shall be constructed in accordance with ASTM Specification for Electric-Resistance-Welded Coiled Steel Tubing for Gas and Fuel Oil Lines (ASTM A539–73), and shall be externally corrosion protected.

(c) *Piping design.* Each mobile home requiring fuel gas for any purpose shall be equipped with a fuel gas piping system that is designed for LP-Gas only or with a natural gas piping system acceptable for LP-Gas.

(1) Where fuel gas piping is to be installed in both portions of an expandable or multiple unit mobile home, the design and construction of the crossover shall be as follows: (i) There shall be only one point of crossover which shall be readily accessible from the exterior of the mobile home. (ii) The connector between units shall be a listed type for exterior use, sized in accordance with § 280.705(d). (iii) The connection shall be made by a listed "quick disconnect" device which shall be designed to provide a positive seal of the supply side of the gas system when such device is separated. (iv) The flexible connector and "quick disconnect" device shall be provided with protection from mechanical and impact damage and located to minimize the possibility of tampering. (v) Suitable protective coverings for the "quick disconnect" device, when separated, shall be permanently attached to the device or flexible connector. (vi) A 3 inch by 1¾ inch minimum size tag made of etched, metal-stamped or embossed brass, stainless steel, anodized or alclad aluminum not less than 0.020 inch thick, or other approved material (e.g., 0.005 inch plastic laminates) shall be permanently attached on the exterior wall adjacent to the access to the "quick disconnect" device. Each tag shall be legibly inscribed with the following information using letters no smaller than ¼ inch high:

Do Not Use Tools to Separate the "Quick-Disconnect" Device.

(d) *Gas Pipe Sizing.* Gas piping systems shall be sized so that the pressure drop to any appliance inlet connection from any gas supply connection, when all appliances are in operation at maximum capacity, is not more than 0.5 inch water column as determined on the basis of test, or in accordance with the following Table. When determining gas pipe sizing in the table, gas shall be assumed to have a specific gravity of 0.65 and rated at 1000 B.T.U. per cubic foot. The natural gas supply connection(s) shall be not less than the size of the gas piping but shall be not smaller than ¾ inch nominal pipe size.

**Part I**

**Maximum Capacity of Different Sizes of Pipe and Tubing in Thousands of Btu's Per Hour of Natural Gas For Gas Pressures of 0.5 Psig or Less and a Maximum Pressure Drop of ½ Inch Water Column**

| | Iron Pipe Sizes | | | | | | | | | | | Tubing | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length in Feet | | | | | | | | | | | Length in Feet | | | | | | | | | |
| I.D. | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | O.D. | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| ¼" | 43 | 29 | 24 | 20 | 18 | 16 | 15 | 14 | 13 | 12 | ⅜" | 27 | 18 | 15 | 13 | 11 | 10 | 9 | 9 | 8 | 8 |
| ⅜" | 95 | 65 | 52 | 45 | 40 | 36 | 33 | 31 | 29 | 27 | ½" | 56 | 38 | 31 | 26 | 23 | 21 | 19 | 18 | 17 | 16 |
| ½" | 175 | 120 | 97 | 82 | 73 | 66 | 61 | 57 | 53 | 50 | ⅝" | 113 | 78 | 62 | 53 | 47 | 43 | 39 | 37 | 34 | 33 |
| ¾" | 360 | 250 | 200 | 170 | 151 | 138 | 125 | 118 | 110 | 103 | ⅞" | 197 | 136 | 109 | 95 | 83 | 75 | 69 | 64 | 60 | 57 |
| 1" | 680 | 465 | 375 | 320 | 285 | 260 | 240 | 220 | 215 | 195 | 1⅛" | 280 | 193 | 155 | 132 | 117 | 106 | 98 | 91 | 85 | 81 |

**Part II**

**Maximum Capacity of Different Sizes of Pipe and Tubing in Thousands of Btu's Per Hour of Undiluted Liquefied Petroleum Gas Based on a Maximum Pressure Drop of ½ Inch Water Column**

| | Iron Pipe | | | | | | | | | | | Tubing | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length in Feet | | | | | | | | | | | Length in Feet | | | | | | | | | |
| I.D. | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | O.D. | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| ¼" | 67 | 46 | 37 | 31 | 28 | 25 | 23 | 21 | 20 | 19 | ⅜" | 39 | 26 | 21 | 19 | — | — | — | — | — | — |
| ⅜" | 147 | 101 | 81 | 70 | 62 | 55 | 51 | 48 | 45 | 42 | ½" | 92 | 62 | 50 | 41 | 37 | 35 | 31 | 29 | 27 | 26 |
| ½" | 275 | 189 | 152 | 129 | 114 | 103 | 96 | 89 | 83 | 78 | ⅝" | 199 | 131 | 107 | 90 | 79 | 72 | 67 | 62 | 59 | 55 |
| ¾" | 567 | 393 | 315 | 267 | 237 | 217 | 196 | 185 | 173 | 162 | ⅞" | 329 | 216 | 181 | 145 | 131 | 121 | 112 | 104 | 95 | 90 |
| 1" | 1071 | 732 | 590 | 504 | 440 | 409 | 378 | 346 | 322 | 307 | 1⅛" | 501 | 346 | 277 | 233 | 198 | 187 | 164 | 155 | 146 | 138 |

(e) *Joints for Gas Pipe.* All pipe joints in the piping system, unless welded or brazed, shall be threaded joints that comply with ANSI Standard Pipe Threads (Except Dryseal) B2-1—1968. Right and left nipples or couplings shall not be used. Unions, if used, shall be of ground joint type. The material used for welding or brazing pipe connections shall have a melting temperature in excess of 1,000 F.

(f) *Joints for Tubing.* (1) Tubing joints shall be made with either a single or a double flare of 45 degrees in accordance with SAE Standard J 533A or with other listed vibration-resistant fittings, or joints may be brazed with material having a melting point exceeding 1,000 F. Metallic ball sleeve compression-type tubing fittings shall not be used.

(2) Steel tubing joints shall be made with a double-flare in accordance with SAE Standard J 533A.

(g) *Pipe Joint Compound.* Screw joints shall be made up tight with listed pipe joint compound, insoluble in liquefied petroleum gas, and shall be applied to the male threads only.

(h) *Concealed Tubing.* Tubing shall not be run inside walls, floors, partitions, or roofs. Where tubing passes through walls, floors, partitions, roofs, or similar installations, such tubing shall be protected by the use of weather resistant grommets that shall snugly fit both the tubing and the hole through which the tubing passes.

(i) *Concealed Joints.* Piping or tubing joints shall not be located in any floor, wall partition, or similar concealed construction space.

(j) *Location of gas supply connection.* (1) For LP-Gas-only systems the supply connection shall be located at the "A" frame, container recess, or in the rear half of the total length of the mobile home and within 24 inches from the left (road) side wall, and should be as close as practicable to a point 30 feet from the front of the mobile home.

(2) For combination LP-Gas and natural gas systems, the natural gas supply connection shall be located under the rear half of the total length of the mobile home and within 24 inches of the left (road) side wall and be located as close as practicable to a point 30 feet from the front of the mobile home. The natural gas supply connection shall not be located beneath any exit door. An additional connection, if used, shall be located at the "A" frame. The system shall be sized to provide adequate capacity from either supply connection for natural gas.

(k) *Identification of gas supply connections.* Each mobile home shall have permanently affixed to the exterior skin at or near each gas supply connection or the end of the pipe, a tag of 3 inches by 1¾ inches minimum size, made of etched, metal-stamped or embossed brass, stainless steel, anodized or alclad aluminum not less than 0.020 inch thick, or other approved material (e.g., 0.005 inch plastic laminates), which reads (as appropriate) in accordance with one of the following label designs depending upon the fuel used. The connector capacity indicated on this tag shall be equal to or greater than the total Btuh rating of all intended gas appliances.

LP-Gas System

This gas piping system is designed for use of liquefied petroleum gas only.

DO NOT CONNECT NATURAL GAS TO THIS SYSTEM.

CONTAINER SHUTOFF VALVES SHALL BE CLOSED DURING TRANSIT.

When connecting to lot outlet, use a listed gas supply connector for mobile homes rated at ☐ 100,000 Btuh or more. ☐ 250,000 Btuh

Before turning on gas, make certain all gas connections have been made tight, all appliance valves are turned off, and any unconnected outlets are capped.

After turning on gas, test gas piping and connections to appliances for leakage with soapy water or bubble solution, and light all pilots.

Combination LP-Gas and Natural Gas System

This gas piping system is designed for use of either liquefied petroleum gas or natural gas.

NOTICE: BEFORE TURNING ON GAS BE CERTAIN APPLIANCES ARE DESIGNED FOR THE GAS CONNECTED AND ARE EQUIPPED WITH CORRECT ORIFICES. SECURELY CAP THIS INLET WHEN NOT CONNECTED FOR USE.

When connecting to lot outlet, use a listed gas supply connector for mobile homes rated at ☐ 100,000 Btuh or more. ☐ 250,000 Btuh

Before turning on gas, make certain all gas connections have been made tight, all appliance valves are turned off, and any unconnected outlets are capped.

After turning on gas, test gas piping and connections to appliances for leakage with soapy water or bubble solution, and light all pilots.

(l) *Gas supply connectors*—(1) *LP-Gas.* A listed LP-Gas flexible connector conforming to the UL Standard for Pigtails, Expansion Coils and Flexible Hose Connectors for LP-Gas (UL 569-1973) or equal shall be supplied when the fuel gas piping system is designed for the use of LP-Gas and cylinder(s) and regulator(s) are supplied.

(2) *Appliance connections.* All gas burning appliances shall be connected to the fuel piping. Materials as provided in § 280.705(b) or listed appliance connectors shall be used. Listed appliance connectors when used shall not run through walls, floors, ceilings or partitions. Connectors of aluminum shall not be used outdoors. A mobile home containing an LPG or combination LP-natural-gas-system may be provided with a gas outlet to supply exterior appliances when installed in accordance with the following: (i) No portion of the completed installation shall project beyond the wall of the mobile home. (ii) The outlet shall be provided with an approved "quick-disconnect" device, which shall be designed to provide a positive seal on the supply side of the gas system when the appliance is disconnected. A shutoff valve shall be installed immediately upstream of the quick-disconnect device. The complete device shall be provided as part of the original installation. (iii) Protective caps or plugs for the "quick-disconnect" device, when disconnected, shall be per-

manently attached to the mobile home adjacent to the device. (iv) A tag shall be permanently attached to the outside of the exterior wall of the mobile home as close as possible to the gas supply connection. The tag shall indicate the type of gas and the Btuh capacity of the outlet and shall be legibly inscribed as follows:

THIS OUTLET IS DESIGNED FOR USE WITH GAS PORTABLE APPLIANCES WHOSE TOTAL INPUT DO NOT EXCEED _____ BTUH. REPLACE PROTECTIVE COVERING OVER CONNECTOR WHEN NOT IN USE.

(3) *Valves.* A shutoff valve shall be installed in the fuel piping at each gas appliance inside the mobile home structure, upstream of the union or connector in addition to any valve on the appliance and so arranged to be accessible to permit servicing of the appliance and removal of its components, and for shutoff in case of emergency. The shutoff valve shall be located within 6 feet of a cooking appliance and within 3 feet of any other appliance. A shutoff valve may serve more than one applicant if located as required above. Shutoff valves used in connection with gas piping shall be of a type designed and listed for use on LP-Gas.

(4) *Gas Piping System Openings.* All openings in the gas piping system shall be closed gas-tight with threaded pipe plugs or pipe caps.

(5) *Electrical Ground.* Gas piping shall not be used for an electrical ground.

(6) *Couplings.* Pipe couplings and unions shall be used to join sections of threaded piping. Right and left nipples or couplings shall not be used.

(7) *Hangers and Supports.* All gas piping shall be adequately supported by galvanized or equivalently protected metal straps or hangers at intervals of not more than 4 feet, except where adequate support and protection is provided by structural members. Solid-iron-pipe gas supply connection(s) shall be rigidly anchored to a structural member within 6 inches of the supply connection(s).

(8) *Testing for Leakage.* (i) Before appliances are connected, piping systems shall stand a pressure of at least six inches mercury or three PSI gage for a period of not less than ten minutes without showing any drop in pressure. Pressure shall be measured with a mercury manometer or slope gage calibrated so as to be read in increments of not greater than one-tenth pound, or an equivalent device. The source of normal operating pressure shall be isolated before the pressure tests are made. Before a test is begun, the temperature of the ambient air and of the piping shall be approximately the same, and constant air temperature be maintained throughout the test. (ii) After appliances are connected, the piping system shall be pressurized to not less than 10 inches nor more than 14 inches water column and the appliance connections tested for leakage with soapy water or bubble solution.

### § 280.706 Oil Piping Systems.

(a) *General.* The requirements of this Section shall govern the installation of all liquid fuel piping attached to any mobile home. None of the requirements listed in this Section shall apply to the piping in the apliance(s).

(b) *Materials.* All materials used for the installation extension, alteration, or repair, of any oil piping systems shall be new and free from defects or internal obstructions. The system shall be made of materials having a melting point of not less than 1,450 F, except as provided in § 280.706(d) and (e). They shall consist of one or more of the materials described in § 280.706(b) (1) through (4). (1) Steel or wrought-iron pipe shall comply with American National Standard for Wrought-Steel or Wrought-Iron Pipe, B36.10—1970. Threaded copper or brass pipe in iron pipe sizes may be used. (2) Fittings for oil piping shall be wrought iron, malleable iron, steel, or brass (containing not more than 75 percent copper). (3) Copper tubing shall be annealed type, Grade K or L conforming to the Specifications for Seamless Copper Water Tube (ASTM B88–72), or shall comply with the specifications for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service, ASTM B280–73, (4) Steel tubing shall have a minimum wall thickness of 0.032 inch for diameters up to ½ inch and 0.049 inch for diameters ½ inch and larger. Steel tubing shall be constructed in accordance with the Specification for Electric-Resistance Welded Coiled Steel Tubing for Gas and Fuel Oil Lines (ASTM A539–73) and shall be externally corrosion protected.

(c) *Size of Oil Piping.* The minimum size of all fuel oil tank piping connecting outside tanks to the appliance shall be no smaller than ⅜ inch OD copper tubing or ¼ inch IPS. If No. 1 fuel oil is used with a listed automatic pump (fuel lifter), copper tubing shall be sized as specified by the pump manufacturer.

(d) *Joints for Oil Piping.* All pipe joints in the piping system, unless welded or brazed, shall be threaded joints which comply with American National Standard for Pipe Threads (Except Dryseal), B2.1—1968. The material used for brazing pipe connections shall have a melting temperature in excess of 1,000 F.

(e) *Joints for Tubing.* Joints in tubing shall be made with either a single or double flare of the proper degree, as recommended by the tubing manufacturer, by means of listed tubing fittings, or brazed with materials having a melting point in excess of 1,000 F.

(f) *Pipe joint compound.* Threaded joints shall be made up tight with listed pipe joint compound which shall be applied to the male threads only.

(g) *Couplings.* Pipe couplings and unions shall be used to join sections of threaded pipe. Right and left nipples or couplings shall not be used.

(h) *Grade of piping.* Fuel oil piping installed in conjunction with gravity feed systems to oil heating equipment shall slope in a gradual rise upward from a central location to both the oil tank and the appliance in order to eliminate air locks.

(i) *Strap hangers.* All oil piping shall be adequately supported by galvanized or equivalently protected metal straps or hangers at intervals of not more than 4 feet, except where adequate support and protection is provided by structural members. Solid-iron-pipe oil supply connection(s) shall be rigidly anchored to a structural member within 6 inches of the supply connection(s).

(j) *Testing for leakage.* Before setting the system in operation, tank installations and piping shall be checked for oil leaks with fuel oil of the same grade that will be burned in the appliance. No other material shall be used for testing fuel oil tanks and piping. Tanks shall be filled to maximum capacity for the final check for oil leakage.

### § 280.707 Heat producing appliances.

(a) Heat-producing appliances and vents, roof jacks and chimneys necessary for their installation in mobile homes shall be listed or certified by a nationally recognized testing agency for use in mobile homes.

(1) A mobile home shall be provided with a comfort heating system. (i) When a mobile home is manufactured to contain a heating appliance, the heating appliance shall be installed by the manufacturer of the mobile home in compliance with applicable sections of this subpart. (ii) When a mobile home is manufactured for field application of an external heating or combination heating/cooling appliance, preparation of the mobile home for this external application shall comply with the applicable sections of this part.

(2) After the effective date specified herein gas and oil burning comfort heating appliances shall have a flue loss of not more than that specified below, and a thermal efficiency of not less than that specified in nationally recognized standards. (See § 280.703)

| Effective date: | *Maximum allowable flue loss* |
|---|---|
| Jan. 1, 1977 | 25 percent |
| Jan. 1, 1976 | 30 percent |

(b) Fuel-burning heat-producing appliances and refrigeration appliances, except ranges and ovens, shall be of the vented type and vented to the outside.

(c) Fuel-burning appliances shall not be converted from one fuel to another fuel unless converted in accordance with the terms of their listing and the appliance manufacturer's instructions.

(d) *Performance Efficiency.* (1) All automatic electric storage water heaters shall have a standby loss not exceeding 43 watts/meter$^2$ (4 watts/FT$^2$) of tank surface area effective January 1, 1977. The method of test for standby loss shall be as described in Section 4.3.1 of ANSI C72.1–72.

(2) All gas and oil-fired automatic storage water heaters shall have a recovery efficiency, $E_r$, and a standby loss, S, as described below, effective January 1, 1977. The method of test of $E_r$ and S shall be as described in Section 2.7 of ANSI Z21.10.1–1974, except that for oil-fired units. CF=1.0, Q=total gallons of oil consumed and H=total heating value of oil in Btu/gallon.

| Storage capacity in gallons | Recovery efficiency | Standby loss |
|---|---|---|
| Less than 25 | At least 75 percent. | Not more than 7.5 percent. |
| 25 up to 35 | do | Not more than 7 percent. |
| 35 or more | do | Not more than 6 percent. |

(e) Each space heating, cooling or combination heating and cooling system shall be provided with at least one readily adjustable automatic control for regulation of living space temperature. The control shall be placed a minimum of 3 feet from the vertical edge of the appliance compartment door. It shall not be located on an exterior wall or on a wall separating the appliance compartment from a habitable room.

**§ 280.708 Clothes dryers.**

(a) *Clothes dryers.* (1) Clothes dryers shall be exhausted to the outside by a moisture-lint exhaust duct and termination fitting. Such termination fittings for gas dryers shall be listed or certified as components of the dryer.

(2) A clothes dryer moisture-lint exhaust duct shall not be connected to any other duct, vent or chimney.

(3) The exhaust duct shall not terminate beneath the mobile home.

(4) Moisture-lint exhaust ducts shall not be connected with sheet metal screws or other fastening devices which extend into the interior of the duct.

(b) *Gas clothes dryer.* A mobile home may be provided with "stubbed in" equipment at the factory to supply a gas clothes dryer for future installation by the owner provided it complies with the following provisions: (1) The "stubbed in" gas outlet shall be provided with a shutoff valve, the outlet of which is closed by threaded pipe plug or cap. (2) The "stubbed in" gas outlet shall be permanently labeled to identify it for use only as the supply connection for a gas clothes dryer. (3) A moisture-lint exhaust duct system shall be roughed in by the manufacturer at the time of original installation. The moisture-lint exhaust system shall comply with provisions of § 280.708(a) (1) through (4).

(c) *Electric clothes dryers.* Electric clothes dryers shall be exhausted to the outside in accordance with the appliance manufacturer's instructions. When a receptacle is installed to supply an electric clothes dryer for future installation by the owner, the moisture-lint exhaust system required by § 280.708(a) (4) shall be roughed in by the manufacturer. The moisture-lint exhaust system shall comply with provisions of § 280.708(a) (1) through (4).

**§ 280.709 Installation of appliances.**

(a) The installation of each appliance shall conform to the terms of its listing and the manufacturer's instructions. The installer shall leave the manufacturer's instructions attached to the appliance. Every appliance shall be secured in place to avoid displacement. For the purpose of servicing and replacement, each appliance shall be both accessible and removable.

(b) Heat-producing appliances shall be so located that no doors, drapes, or other such material can be placed or swing closer to the front of the appliance than the clearances specified on the labeled appliances.

(c) Clearances between heat-producing appliances and adjacent surfaces shall not be less than specified in the terms of their listing. Clearance spaces shall be framed in or guarded to prevent creation of storage space within the clearance specified.

(d) All fuel-burning appliances, except ranges, ovens, illuminating appliances, clothes dryers, solid fuel-burning fireplaces and solid fuel-burning fireplace stoves, shall be installed to provide for the complete separation of the combustion system from the interior atmosphere of the mobile home. Combustion air inlets and flue gas outlets shall be listed or certified as components of the appliance. The required separation may be obtained by:

(1) The installation of direct vent system (sealed combustion system) appliances, or

(2) The installation of appliances within enclosures so as to separate the appliance combustion system and venting system from the interior atmosphere of the mobile home. There shall not be any door, removable access panel, or other opening into the enclosure from the inside of the mobile home. Any opening for ducts, piping, wiring, etc., shall be sealed.

(e) A forced air appliance and its return-air system shall be designed and installed so that negative pressure created by the air-circulating fan cannot affect its or another appliance's combustion air supply or act to mix products of combustion with circulating air.

(1) The air circulating fan of a furnace installed in an enclosure with another fuel-burning appliance shall be operable only when any door or panel covering an opening in the furnace fan compartment or in a return air plenum or duct is in the closed position. This does not apply if both appliances are direct vent system (sealed combustion system) appliances.

(2) If a warm air appliance is installed within an enclosure to conform to § 280.709(d)(2), each warm-air outlet and each return air inlet shall extend to the exterior of the enclosure. Ducts, if used for that purpose, shall not have any opening within the enclosure and shall terminate at a location exterior to the enclosure.

(3) Cooling coils installed as a portion of, or in connection with, any forced-air furnace shall be installed on the downstream side unless the furnace is specifically otherwise listed.

(4) An air conditioner evaporator section shall not be located in the air discharge duct or plenum of any forced-air furnace unless the mobile home manufacturer has complied with certification required in § 280.511.

(5) If a cooling coil is installed with a forced-air furnace, the coil shall be installed in accordance with its listing. When a furnace-coil unit has a limited listing, the installation must be in accordance with that listing.

(6) When an external heating appliance or combination cooling/heating appliance is to be applied to a mobile home, the manufacturer shall make provision for proper location of the connection to the mobile home supply system and return air system of the external ducts connected to the appliance.

(7) The installation of a self contained air conditioner comfort cooling appliance shall meet the following requirements: (i) The installation on a duct common with an installed heating appliance shall require the installation of an automatic damper or other means to prevent the cooled air from passing through the heating appliance unless the heating appliance is certified or listed for such application and the supply system is intended for such an application. (ii) The installation shall prevent the flow of heated air into the external cooling appliance and its connecting ducts to the mobile home supply and return air system during the operation of the heating appliance installed in the mobile home. (iii) The installation shall prevent simultaneous operation of the heating and cooling appliances.

(f) *Vertical clearance above cooking top.* Ranges shall have a vertical clearance above the cooking top of not less than 24 inches. (See § 280.204).

(g) Solid fuel-burning factory-built fireplaces and fireplace stoves listed for use in mobile homes may be installed in mobile homes provided they and their installation conform to the following paragraphs. A fireplace or fireplace stove shall not be considered as a heating facility for determining compliance with Subpart F.

(1) A solid fuel-burning fireplace or fireplace stove shall be equipped with integral door(s) or shutter(s) designed to close the fireplace or fireplace stove fire chamber opening and shall include complete means for venting through the roof, a combustion air inlet, a hearth extension, and means to securely attach the fireplace or the fireplace stove to the mobile home structure. The installation shall conform to the following paragraphs (g)(1) (i) to (vii) inclusive: (i) A listed factory-built chimney designed to be attached directly to the fireplace or fireplace stove shall be used. The listed factory built chimney shall be equipped with and contain as part of its listing a termination device(s) and a spark arrester(s). (ii) A fireplace or fireplace stove, air intake assembly, hearth extension and the chimney shall be installed in accordance with the terms of their listings and their manufacturer's instructions. (iii) The combustion air inlet shall conduct the air directly into the fire chamber and shall be designed to prevent material from the hearth dropping onto the area beneath the mobile home. (iv) The fireplace or fireplace stove shall not be installed in a sleeping room. (v) Hearth extension shall be of noncombustible material not less than ⅜-inch thick. The hearth shall extend at least 16 inches in front or and at least 8 inches beyond each side of the fireplace

or fireplace stove opening. Furthermore the hearth shall extend over the entire surface beneath a fireplace stove and beneath an elevated or overhanging fireplace. (vi) The label on each solid fuel-burning fireplace and solid fuel-burning fireplace stove shall include the following wording: For use with solid fuel only. (vii) The chimney shall extend at least three feet above the part of the roof through which it passes and at least two feet above the highest elevation of any part of the mobile home within 10 feet of the chimney. Portions of the chimney and termination that exceed an elevation of 13½ ft. above ground level may be designed to be removed for transporting the mobile home.

**§ 280.710 Venting, ventilation and combustion air.**

(a) The venting as required by § 280.707 (b) shall be accomplished by one or more of the methods given in (1) and (2) below:

(1) An integral vent system listed or certified as part of the appliance.

(2) A venting system consisting entirely of listed components, including roof jack, installed in accordance with the terms of the appliance listing and the appliance manufacturer's instructions.

(b) Venting and combustion air systems shall be installed in accordance with the following:

(1) Components shall be securely assembled and properly aligned using the method shown in the appliance manufacturer's instructions.

(2) Draft hood connectors shall be firmly attached to draft hood outlets or flue collars by sheet metal screws or by equivalent effective mechanical fasteners.

(3) Every joint of a vent, vent connector, exhaust duct and combustion air intake shall be secure and in alignment.

(c) Venting systems shall not terminate underneath a mobile home.

(d) Venting system terminations shall be not less than three feet from any motor-driven air intake discharging into habitable areas.

(e) The area in which cooking appliances are located shall be ventilated by a metal duct which may be single wall, not less than 12.5 square inches in cross-sectional area (minimum dimension shall be two inches) located above the appliance(s) and terminating outside the mobile home, or by listed mechanical ventilating equipment discharging outside the home, that is installed in accordance with the terms of listing and the manufacturer's instructions. Gravity or mechanical ventilation shall be installed within a horizontal distance of not more than ten feet from the vertical front of the appliance(s).

(f) Mechanical ventilation which exhausts directly to the outside atmosphere from the living space of a home shall be equipped with an automatic or manual damper. Operating controls shall be provided such that mechanical ventilation can be separately operated without directly energizing other energy consuming devices.

**§ 280.711 Instructions.**

Operating instructions shall be provided with each appliance. These instructions shall include directions and information covering the proper use and efficient operation of the appliance and its proper maintenance.

**§ 280.712 Marking.**

(a) Information on clearances, input rating, lighting and shutdown shall be attached to the appliances with the same permanence as the nameplate, and so located that it is easily readable when the appliance is properly installed or shutdown for transporting of mobile home.

(b) Each fuel-burning appliance shall bear permanent marking designating the type(s) of fuel for which it is listed.

**§ 280.713 Accessibility.**

Every appliance shall be accessible for inspection, service, repair, and replacement without removing permanent construction. Sufficient room shall be available to enable the operator to observe the burner, control, and ignition means while starting the appliance.

**§ 280.714 Appliances, cooling.**

(a) Every air conditioning unit or a combination air conditioning and heating unit shall be listed or certified by a nationally recognized testing agency for the application for which the unit is intended and installed in accordance with the terms of its listing.

(1) Mechanical air conditioners shall be rated in accordance with the Standard for Unitary Air-Conditioning Equipment (ARI Standard 210–74) and certified by ARI or other nationally recognized testing agency capable of providing follow-up service. (i) Electric motor-driven unitary cooling systems with rated capacity less than 65,000 Btu/hr manufactured after the times indicated in the following table, when rated at ARI Standard rating conditions as listed in ARI Standard 210–74, shall show energy efficiency ratio (EER) values not less than as shown below:

| Date: | *Energy efficiency ratio* |
|---|---|
| Jan. 1, 1977 | 6.5 |
| Jan. 1, 1980 | 7.2 |

(ii) Direct refrigerating systems serving any air conditioning or comfort-cooling system installed that ranks no lower than Group 5 in the Underwriters' Laboratories, Inc. "Classification of Comparative Life Hazard of Various Chemicals." (iii) Heat pumps shall be listed in the ARI Directory of Certified Unitary Heat Pumps or certified to comply with all the requirements of the Standard for Unitary Heat Pumps 240–74. Electric motor-driven vapor compression heat pumps with supplemental electrical resistance heat shall be sized to provide by compression at least 60 percent of the calculated annual heating requirement for the mobile home being served. A control shall be provided and set to prevent operation of supplemental electrical resistance heat at outdoor temperatures above 40 F, except for defrost operation. (iv) Electric motor-driven vapor compression heat pumps with supplemental electric resistance heat conforming to ARI Standard 240–74 manufactured after the dates indicated in the table shall show coefficient of performance ratios not less than shown below:

*COP*

| Date | Outdoor air temperature | | |
|---|---|---|---|
| | 45° F | 20° F | 0° F |
| Jan. 1, 1977 | 2.2 | 1.4 | Permit shutoff. |
| Jan. 1, 1980 | 2.5 | 1.7 | 1.0. |

(2) Gas fired absorption air conditioners shall be listed or certified in cordance with ANSI Standard Z21.40.1–1973 and certified by AGA or another nationally recognized testing agency capable of providing follow-up service.

(3) Direct refrigerating systems serving any air conditioning or comfort-cooling system installed in a mobile home shall employ a type of refrigerant that ranks no lower than Group 5 in the Underwriters' Laboratories, Inc. "Classification of Comparative Life Hazard of Various Chemicals."

(b) *Installation and instructions.*

(1) The installation of each appliance shall conform to the terms of its listing as specified on the appliance and in the manufacturer's instructions. The installer shall include the manufacturer's installation instructions in the mobile home. Appliances shall be secured in place to avoid displacement and movement from vibration and road shock.

(2) Operating instructions shall be provided with the appliance.

(c) Fuel-burning air conditioners shall also comply with § 280.707.

(d) The appliance rating plate shall be so located that it is easily readable when the appliance is properly installed.

(e) Every installed appliance shall be accessible for inspection, service, repair and replacement without removing permanent construction.

**§ 280.715 Circulating air system.**

(a) *Supply system.* (1) Supply ducts and any dampers contained therein shall be made from galvanized steel, tin-plated steel, or aluminum, or shall be listed Class 0, Class 1, or Class 2 air ducts. Class 2 air ducts shall be located at least 3 feet from the furnace bonnet or plenum. A duct system integral with the structure shall be of durable construction that can be demonstrated to be equally resistant to fire and deterioration. Ducts constructed from sheet metal shall be in accordance with the following table:

*Minimum metal thickness for ducts* [1]

| Duct type | Diameter 14 in or less | Width over 14 in |
|---|---|---|
| Round | 0.013 | 0.016 |
| Enclosed rectangular | .013 | .016 |
| Exposed rectangular | .016 | .019 |

[1] When "nominal" thicknesses are specified, 0.003 in shall be added to these "minimum" metal thicknesses.

(2) Sizing of ducts for heating. (i) Ducts shall be so designed that when a labeled forced-air furnace is installed and operated continuously at its normal heating air circulating rate in the mobile home, with all registers in the full open position, the static pressure measured in the casing shall not exceed 90% of that shown on the label of the appliance. For upflow furnaces the static pressure shall be taken in the duct plenum. For external heating or combination heating/cooling appliances the static pressure shall be taken at the point used by the agency listing or certifying the appliance. (ii) When an evaporator-coil specifically designed for the particular furnace is installed between the furnace and the duct plenum, the total static pressure shall be measured downstream of the coil in accordance with the appliance label and shall not exceed 90 percent of that shown on the label of the appliance. (iii) When any other listed air-cooler coil is installed between the furnace and the duct plenum, the total static pressure shall be measured between the furnace and the coil and it shall not exceed 90 percent of that shown on the label of the furnace. (iv) The minimum dimension of any branch duct shall be at least 1½ inches, and of any main duct, 2½ inches.

(3) Sizing of ducts for air cooling. (i) The mobile home manufacturer shall certify the capacity of the air cooling supply duct system for the maximum allowable output of ARI certified central air conditioning systems. The certification shall be at operating static pressure of 0.3 inches of water or greater. (See § 280.511). (ii) The refrigerated air cooling supply duct system including registers must be capable of handling at least 300 cfm per 10,000 btuh with a static pressure no greater than 0.3 inches of water when measured at room temperature. In the case of application of external self contained comfort cooling appliances or the cooling mode of combination heating/cooling appliances, either the external ducts between the appliance and the mobile home supply system shall be considered part of, and shall comply with the requirements for the refrigerated air cooling supply duct system, or the connecting duct between the external appliance and the mobile supply duct system shall be a part of the listed appliance. The minimum dimension of any branch duct shall be at least 1½ inches, and of any main duct, 2½ inches.

(4) Airtightness of supply duct systems. A supply duct system shall be considered substantially airtight when the static pressure in the duct system, with all registers sealed and with the furnace air circulator at high speed, is at least 80 percent of the static pressure measured in the furnace casing, with its outlets sealed and the furnace air circulator operating at high speed. For the purpose of this paragraph and § 280.715(b) pressures shall be measured with a water manometer or equivalent device calibrated to read in increments not greater than $\frac{1}{10}$ inch water column.

(5) Expandable or multiple mobile home connections. (i) An expandable or multiple mobile home may have ducts of the heating system installed in the various units. The points of connection must be so designed and constructed that when the mobile home is fully expanded or coupled, the resulting duct joint will conform to the requirements of this Part. (ii) Installation instructions for supporting the crossover duct from the mobile home shall be provided for onsite installation. The duct shall not be in contact with the ground.

(6) Air supply ducts shall be insulated with material having an effective thermal resistance (R) of not less than 4.0 unless they are within mobile home insulation having a minimum effective value of R–4.0 for floors or R–6.0 for ceilings.

(7) Supply and return ducts exposed directly to outside air, such as under chassis crossover ducts or ducts connecting external heating, cooling or combination heating/cooling appliances shall be insulated with material having a minimum thermal resistance of R=4.0, with a continuous vapor barrier having a perm rating of not more than 1 perm. Where exposed underneath the mobile home, all such ducts shall comply with § 280.715 (a)(5)(ii).

(b) *Return air systems.* (1) *Return air openings.* Provisions shall be made to permit the return of circulating air from all rooms and living spaces, except toilet room(s), to the circulating air supply inlet of the furnace.

(2) *Duct Material.* Return ducts and any diverting dampers contained therein shall be in accordance with the following: (i) Portions of return ducts directly above the heating surfaces, or closer than 2 feet from the outer jacket or casing of the furnace shall be constructed of metal in accordance with § 280.715(a)(1) or shall be listed Class 0 or Class 1 air ducts. (ii) Return ducts, except as required by (a) above, shall be constructed of one-inch (nominal) wood boards (flame spread classification of not more than 200), other suitable material no more flammable than one-inch board or in accordance with § 280.715(a)(1). (iii) The interior of combustible ducts shall be lined with noncombustible material at points where there might be danger from incandescent particles dropped through the register or furnace such as directly under floor registers and the bottom return. (iv) Factory made air ducts used for connecting external heating, cooling or combination heating/cooling appliances to the supply system and return air system of a mobile home shall be listed by a nationally recognized testing agency. Ducts applied to external heating appliances or combination heating/cooling appliances supply system outlets shall be constructed of metal in accordance with § 280.715(a)(1) or shall be listed Class 0 or Class 1 air ducts for those portions of the duct closer than 2 feet from the outer casing of the appliance. (v) Ducts applied to external appliances shall be resistant to deteriorating environmental effects, including but not limited to ultra violet rays, cold weather, or moisture and shall be resistant to insects and rodents.

(3) *Sizing.* The cross-sectional areas of the return air duct shall not be less than 2 square inches for each 1,000 Btu per hour input rating of the appliance. Dampers shall not be placed in a combination fresh air intake and return air duct so arranged that the required cross-sectional area will not be reduced at all possible positions of the damper.

(4) *Permanent unclosable openings.* Living areas not served by return air ducts or closed off from the return opening of the furnace by doors, sliding partitions, or other means shall be provided with permanent unclosable openings in the doors or separating partitions to allow circulated air to return to the furnace. Such openings may be grilled or louvered. The net free area of each opening shall be not less than 1 square inch for every 5 square feet of total living area closed off from the furnace by the door or partition serviced by that opening. Undercutting doors connecting the closed-off space may be used as a means of providing return air area. However, in the event that doors are undercut, they shall be undercut a minimum of 2 inches and no more than 2½ inches, and no more than one half of the free air area so provided shall be counted as return air area.

(c) *Joints and seams.* Joints and seams of ducts shall be securely fastened and made substantially airtight. Slip joints shall have a lap of at least 1 inch and shall be individually fastened. Tape or caulking compound may be used for sealing mechanically secure joints. Where used, tape or caulking compound shall not be subject to deterioration under long exposures to temperatures up to 200° F. and to conditions of high humidity, excessive moisture, or mildew.

(d) *Supports.* Ducts shall be securely supported.

(e) *Registers or grilles.* Fittings connecting the registers or grilles to the duct system shall be constructed of metal or material which complies with the requirements of Class 1 or 2 ducts under Underwriters' Laboratories, Inc. Standard for Air Ducts, UL181–1972. Air supply terminal devices (registers) when installed in kitchens, bedrooms and bathrooms shall be equipped with adjustable closeable dampers. Registers or grilles shall be constructed of metal or conform with the following:

(1) Be made of a material classified 94VE–0 or 94VE–1 when tested as described in Underwriters' Laboratories, Inc. Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances. UL94–1974.

(2) Floor register or grilles shall resist without structural failure a 200 lb. concentrated load on a 2-inch diameter disc applied to the most critical area of the exposed face of the register or grille. For this test the register or grille is to be at a temperature of not less than 165° F and is to be supported in accordance with the manufacturer's instructions.

### Subpart I—Electrical Systems

**§ 280.801 Scope.**

(a) Subpart I of this Standard and Part A of Article 550 of the National Electrical Code (NFPA No. 70—1975) cover the electrical conductors and equipment installed within or on mobile homes and the conductors that connect mobile homes to a supply of electricity.

(b) In addition to the requirements of this Standard and Article 550 of the National Electrical Code (NFPA No. 70—1975), the applicable portions of other Articles of the National Electrical Code shall be followed covering electrical installations in mobile homes. Wherever the requirements of this Standard differ from the National Electrical Code, this Standard shall apply.

(c) The provisions of this Standard apply to mobile homes intended for connection to a wiring system nominally rated 115/230 volts, 3-wire AC, with grounded neutral.

(d) All electrical materials, devices, appliances, fittings and other equipment shall be listed or labeled by a nationally recognized testing agency and shall be connected in an approved manner when in service.

(e) Aluminum conductors are not acceptable in branch circuit wiring in mobile homes except as specifically approved by the Department after examination of proposed systems for individual cases.

**§ 280.802 Definitions.**

(a) The following definitions are applicable to Subpart I only.

(1) "Accessible (i) (As Applied to Equipment)" means admitting close approach because not guarded by locked doors, elevation, or other effective means. (See "Readily Accessible.") (ii) "(As Applied to Wiring Methods) means capable of being removed or exposed without damaging the mobile home structure or finish, or not permanently closed-in by the structure or finish of the mobile home (see "Concealed" and "Exposed").

(2) "Air Conditioning or Comfort Cooling Equipment" means all of that equipment intended or installed for the purpose of processing the treatment of air so as to control simultaneously its temperature, humidity, cleanliness, and distribution to meet the requirements of the conditioned space.

(3) (i) "Appliance" means utilization equipment, generally other than industrial, normally built in standardized sizes or types, which is installed or connected as a unit to perform one or more functions, such as clothes washing, air conditioning, food mixing, deep frying, etc. (ii) "Appliance, Fixed" means an appliance which is fastened or otherwise secured at a specific location. (iii) "Appliance, Portable" means an appliance which is actually moved or can easily be moved from one place to another in normal use. For the purpose of this Standard, the following major appliances are considered portable if cord-connected: refrigerators, clothes washers, dishwashers without booster heaters, or other similar appliances. (iv) "Appliance, Stationary" means an appliance which is not easily moved from one place to another in normal use.

(4) "Attachment Plug (Plug Cap) (Cap)" means a device which, by insertion in a receptacle, establishes connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle.

(5) "Bonding" means the permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed.

(6) "Branch Circuit" (i) means the circuit conductors between the final overcurrent device protecting the circuit and the outlet(s). A device not approved for branch circuit protection, such as a thermal cutout or motor overload protective device, is not considered as the overcurrent device protecting the circuit. (ii) "Branch Circuit—Appliance" means a branch circuit supplying energy to one or more outlets to which appliances are to be connected; such circuits to have no permanently connected lighting fixtures not a part of an appliance. (iii) "Branch Circuit—General Purpose" means a circuit that supplies a number of outlets for lighting and appliances. (iv) "Branch Circuit—Individual" means a branch circuit that supplies only one utilization equipment.

(7) "Cabinet" means an enclosure designed either for surface or flush mounting, and provided with a frame, mat, or trim in which swinging doors are hung.

(8) "Circuit Breaker" means a device designed to open and close a circuit by nonautomatic means, and to open the circuit automatically on a predetermined overload of current without injury to itself when properly applied within its rating.

(9) "Concealed" means rendered inaccessible by the structure or finish of the mobile home. Wires in concealed raceways are considered concealed, even though they may become accessible by withdrawing them. (See "Accessible (As Applied to Wiring Methods)")

(10) "Connector, Pressure (Solderless)" means a device that establishes a connection between two or more conductors or between one or more conductors and a terminal by means of mechanical pressure and without the use of solder.

(11) "Dead Front (As Applied to Switches, Circuit-Breakers, Switchboards, and Distribution Panelboard)" means so designed, constructed, and installed that no current-carrying parts are normally exposed on the front.

(12) "Demand Factor" means the ratio of the maximum demand of a system, or part of a system, to the total connected load of a system or the part of the system under consideration.

(13) "Device" means a unit of an electrical system that is intended to carry but not utilize electrical energy.

(14) "Disconnecting Means" means a device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

(15) "Distribution Panelboard" means a single panel or a group of panel units designed for assembly in the form of a single panel, including buses, and with or without switches or automatic overcurrent protective devices or both, for the control of light, heat, or power circuits of small individual as well as aggregate capacity; designed to be placed in a cabinet placed in or against a wall or partition and accessible only from the front.

(16) "Enclosed" means surrounded by a case that will prevent a person from accidentally contacting live parts.

(17) "Equipment" means a general term, including material, fittings, devices, appliances, fixtures, apparatus, and the like used as a part of, or in connection with, an electrical installation.

(18) "Exposed" (i) (As Applied to Live Parts) means capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts not suitably guarded, isolated, or insulated. (See "Accessible" and "Concealed.") (ii) (As Applied to "Wiring Method") means on or attached to the surface or behind panels designed to allow access. (See "Accessible (As Applied to Wiring Methods)")

(19) "Externally Operable" means capable of being operated without exposing the operator to contact with live parts.

(20) "Feeder Assembly" means the overhead or under-chassis feeder conductors, including the grounding conductor, together with the necessary fittings and equipment, or a power supply cord approved for mobile home use, designed for the purpose of delivering energy from the source of electrical supply to the distribution panelboard within the mobile home.

(21) "Fitting" means an accessory, such as a locknut, bushing, or other part of a wiring system, that is intended primarily to perform a mechanical rather than an electrical function.

(22) "Ground" means a conducting connection, whether intentional or accidental, between an electrical circuit or equipment and earth, or to some conducting body that serves in place of the earth.

(23) "Grounded" means connected to earth or to some conducting body that serves in place of the earth.

(24) "Grounded Conductor" means a system or circuit conductor that is intentionally grounded.

(25) "Grounding Conductor" means a conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes.

(26) "Guarded" means covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger.

(27) "Isolated" means not readily accessible to persons unless special means for access are used.

(28) "Laundry Area" means an area containing or designed to contain either a laundry tray, clothes washer and/or clothes dryer.

(29) "Lighting Outlet" means an outlet intended for the direct connection of a lampholder, a lighting fixture, or a pendant cord terminating in a lampholder.

(30) "Mobile Home Accessory Building or Structure" means any awning, cabana, ramada, storage cabinet, carport, fence, windbreak or porch established for the use of the occupant of the mobile home upon a mobile home lot.

(31) "Mobile Home Service Equipment" means the equipment containing the disconnecting means, overcurrent protective devices, and receptacles or other means for connecting a mobile home feeder assembly.

(32) 'Outlet" means a point on the wiring system at which current is taken to supply utilization equipment.

(33) "Panelboard" means a single panel or group of panel units designed for assembly in the form of a single panel; including buses, automatic overcurrent protective devices, and with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall or partition and accessible only from the front.

(34) "Raceway" means any channel for holding wires, cables, or busbars that is designed expressly for, and used solely for, this purpose. Raceways may be of metal or insulating material, and the term includes rigid metal conduit, rigid nonmetallic conduit, flexible metal conduit, electrical metallic tubing, underfloor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, structural raceways, wireways, and busways.

(35) "Raintight" means so constructed or protected that exposure to a beating rain will not result in the entrance of water.

(36) "Readily Accessible" means capable of being reached quickly for operation, renewal, or inspection, without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, chairs, etc. (See "Accessible.")

(37) "Receptacle" means a contact device installed at an outlet for the connection of a single attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is a single device containing two or more receptacles.

(38) "Receptacle Outlet" means an outlet where one or more receptacles are installed.

(39) "Utilization Equipment" means equipment which utilizes electric energy for mechanical, chemical, heating, lighting, or similar purposes.

(40) "Voltage (of a Circuit)" means the greatest root-mean-square (effective) difference of potential between any two conductors of the circuit concerned. Some systems, such as 3-phase 4-wire, single-phase 3-wire, and 3-wire direct-current may have various circuits of various voltages.

(41) "Weatherproof" means so constructed or protected that exposure to the weather will not interfere with successful operation. Rainproof, raintight, or watertight equipment can fulfill the requirements for weatherproof where varying weather conditions other than wetness, such as snow, ice, dust, or temperature extremes, are not a factor.

**§ 280.803 Power supply.**

(a) The power supply to the mobile home shall be a feeder assembly consisting of not more than one listed 50 ampere mobile home power-supply cords, or a permanently installed circuit. A mobile home that is factory-equipped with gas or oil-fired central heating equipment and cooking appliances shall be permitted to be provided with a listed mobile home power-supply cord rated 40 amperes.

(b) If the mobile home has a power-supply cord, it shall be permanently attached to the distribution panelboard or to a junction box permanently connected to the distribution panelboard, with the free end terminating in an attachment plug cap.

(c) Cords with adapters and pigtail ends, extension cords, and similar items shall not be attached to, or shipped with, a mobile home.

(d) A listed clamp or the equivalent shall be provided at the distribution panelboard knockout to afford strain relief for the cord to prevent strain from being transmitted to the terminals when the power-supply cord is handled in its intended manner.

(e) The cord shall be of an approved type with four conductors, one of which shall be identified by a continuous green color or a continuous green color with one or more yellow stripes for use as the grounding conductor.

(f) The attachment plug cap shall be a 3-pole, 4-wire grounding type, rated 50 amperes, 125/250 volts with a configuration as shown herein and intended for use with the 50-ampere, 125/250 receptacle configuration shown. It shall be molded of butyl rubber, neoprene, or other approved materials which have been found suitable for the purpose, and shall be molded to the flexible cord so that it adheres tightly to the cord at the point where the cord enters the attachment-plug cap. If a right-angle cap is used, the configuration shall be so oriented that the grounding member is farthest from the cord.

(g) The overall length of a power-supply cord, measured from the end of the cord, including bared leads, to the face of the attachment-plug cap shall not be less than 21 feet and shall not exceed 36½ feet. The length of cord from the face of the attachment-plug cap to the point where the cord enters the mobile home shall not be less than 20 feet.

50-ampere 125/250 volt receptacle and attachment-plug-cap configurations, 3 pole, 4-wire grounding types used for mobile home supply cords and mobile home parks. Complete details of the 50-ampere cap and receptacle can be found in the American National Standard Dimensions of Caps, Plugs and Receptacles, Grounding Type (ANSI C73.17—1972).

(h) The power-supply cord shall bear the following marking: "For use with mobile homes—40 amperes" or "For use with mobile homes—50 amperes."

(i) The point of entrance of the feeder assembly to the mobile home shall be in the exterior wall, floor, or roof, in the rear third section (away from the coupler), of the mobile home.

(j) Where the cord passes through walls or floors, it shall be protected by means of conduit and bushings or equivalent. The cord may be installed within the mobile home walls, provided a continuous raceway is installed from the branch-circuit panelboard to the underside of the mobile home floor. The raceway may be rigid conduit, electrical metallic tubing or polyethylene (PE), poly-vinylchloride (PVC) or acrylonitrile-butadiene-styrene (ABS) plastic tubing having a minimum wall thickness of nominal ⅛ inch.

(k) Permanent provisions shall be made for the protection of the attachment-plug cap of the power supply cord and any connector cord assembly or receptacle against corrosion and mechanical damage if such devices are in an exterior location while the mobile home is in transit.

(l) Where the calculated load exceeds 50 amperes or where a permanent feeder is used, the supply shall be by means of:

(1) One mast weatherhead installation installed in accordance with Article 230 of the National Electrical Code NFPA No. 70—1975 containing four continuous insulated, color-coded, feeder conductors, one of which shall be an equipment grounding conductor; or,

(2) An approved raceway from the disconnecting means in the mobile home to the underside of the mobile home with provisions for the attachment of a suitable junction box or fitting to the raceway on the underside of the mobile home. The manufacturer shall provide in his written installation instructions, the proper feeder conductor sizes for the raceway and the size of the junction box to be used.

**§ 280.804 Disconnecting means and branch-circuit protective equipment.**

(a) The branch-circuit equipment shall be permitted to be combined with

the disconnecting means as a single assembly. Such a combination shall be permitted to be designated as a distribution panelboard. If a fused distribution panelboard is used, the maximum fuse size of the mains shall be plainly marked with lettering at least ¼-inch high and visible when fuses are changed. See Section 110-22 of the National Electrical Code (NFPA No. 70—1975) concerning identification of each disconnecting means and each service, feeder, or branch circuit at the point where it originated and the type marking needed.

(b) Plug fuses and fuseholders shall be tamper-resistant, Type "S," enclosed in dead-front fuse panelboards. Electrical distribution panels containing circuit breakers shall also be dead-front type.

(c) Disconnectiong means. A single disconnecting means shall be provided in each mobile home consisting of a circuit breaker, or a switch and fuses and their accessories installed in a readily accessible location near the point of entrance of the supply cord or conductors into the mobile home. The main circuit breakers or fuses shall be plainly marked "Main." This equipment shall contain a solderless type of grounding connector or bar for the purposes of grounding with sufficient terminals for all grounding conductors. The neutral bar termination of the grounded circuit conductors shall be insulated.

(d) The disconnecting equipment shall have a rating suitable for the connected load. The distribution equipment, either circuit breaker or fused type, shall be located a minimum of 24 inches from the bottom of such equipment to the floor level of the mobile home. There shall be a label attached to the panelboard stating: This Panelboard shall be connected by a Feeder Assembly having Overcurrent Protection rated at not more than _____ Amperes. The correct ampere rating shall be marked in the blank space.

(e) A distribution panelboard employing a main circuit breaker shall be rated 50 amperes and employ a 2-pole circuit breaker rated 40 amperes for a 40-ampere supply cord, or 50 amperes for a 50-ampere supply cord. A distribution panelboard employing a disconnect switch and fuses shall be rated 60 amperes and shall employ a single 2-pole, 60-ampere fuseholder with 40- or 50-ampere main fuses for 40- or 50-ampere supply cords, respectively. The outside of the distribution panelboard shall be plainly marked with the fuse size.

(f) The distribution panelboard shall not be located in a bathroom, or in any other inaccessible location, but shall be permitted just inside a closet entry if the location is such that a clear space of 6 inches to easily ignitable materials is maintained in front of the distribution panelboard, and the distribution panelboard door can be extended to its full open position (at least 90 degrees). A clear working space at least 30 inches wide and 30 inches in front of the distribution panelboard shall be provided. This space shall extend from floor to the top of the distribution panelboard.

(g) Branch-circuit distribution equipment shall be installed in each mobile home and shall include overcurrent protection for each branch circuit consisting of either circuit breakers or fuses.

(1) The branch circuit overcurrent devices shall be rated: (i) not more than the circuit conductors; and (ii) not more than 150 percent of the rating of a single appliance rated 10 amperes or more which is supplied by an individual branch circuit; but (iii) not more than the fuse size marked on the air conditioner or other motor-operated appliance.

(h) A 15-ampere multiple receptacle shall be acceptable when connected to a 20-ampere laundry circuit.

(i) When circuit breakers are provided for branch-circuit protection, 230-volt circuits shall be protected by 2-pole common or companion trip, or handle-tied paired circuit breakers.

(j) A metal nameplate on the outside adjacent to the feeder assembly entrance shall read: This Connection for 120/240 Volt, 3-Pole, 4-Wire, 60 Hertz_____ Ampere Supply. The correct ampere rating shall be marked in the blank space.

**§ 280.805 Branch circuits required.**

(a) The number of branch circuits required shall be determined in accordance with the following:

(1) *Lighting.* Based on 3 watts per square foot times outside dimensions of the mobile home (coupler excluded) divided by 115 volts times amperage to determine number of 15- or 20-ampere lighting area circuits, e.g.,

$$\frac{3 \times \text{Length} \times \text{Width}}{115 \times 15 \text{ (or } 20)} = \text{No. of 15 (or 20) ampere circuits}$$

(2) *Portable appliances.* For the small appliance load in kitchen, pantry, family room, dining room and breakfast rooms of mobile homes, two or more 20-ampere appliance branch circuits, in addition to the branch circuit specified in § 280.805 (a)(1), shall be provided for all receptacle outlets in these rooms, and such circuits shall have no other outlets. Receptacle outlets supplied by at least two appliance receptacle branch circuits shall be installed in the kitchen.

(3) *General appliances (Including furnace, water heater, range, and central or room air conditioner, etc.).* There shall be one or more circuits of adequate rating in accordance with the following: (i) Ampere rating of fixed appliances not over 50 percent of circuit rating if lighting outlets (receptacles, other than kitchen, dining area, and laundry, considered as lighting outlets) are on same circuit; (ii) For fixed appliances on a circuit without lighting outlets, the sum of rated amperes shall not exceed the branch-circuit rating for other than motor loads or 80 percent of the branch-circuit rating for air conditioning or other motor loads; (iii) The rating of a single portable appliance on a circuit having no other outlets shall not exceed 80 percent of the circuit rating; (iv) The rating of range branch circuit shall be based on the range demand as specified for ranges in § 280.811, Item B(5) of Method 1. For central air conditioning, see Article 440 of the National Electrical Code (NFPA No. 70—1975). (v) Where laundry facilities are provided in a mobile home, a 20-ampere branch circuit shall be provided within 6 feet of the intended location of the appliance. See § 280.804(j).

**§ 280.806 Receptacle Outlets.**

(a) All receptacle outlets shall be:

(1) Of grounding type;

(2) Installed according to Section 210-7 of the National Electrical Code (NFPA No. 70 ___ 1975) and

(3) Except when supplying specific appliances, be parallel-blade, 15-ampere, 125-volt, either single or duplex.

(b) All 120 volt single phase, 15 and 20 ampere receptacle outlets, including receptacles in light fixtures, installed outdoors and in bathrooms shall have ground-fault circuit protection for personnel. Feeders supplying branch circuits may be protected by a ground-fault circuit-interrupter in lieu of the provision for such interrupters specified above.

(c) There shall be an outlet of the grounding type for each cord-connected fixed appliance installed.

(d) Receptacle outlets required. Except in the bath and hall areas, receptacle outlets shall be installed at wall spaces 2 feet wide or more, so that no point along the floor line is more than 6 feet, measured horizontally, from an outlet in that space. In addition, a receptacle outlet shall be installed:

(1) Over or adjacent to counter tops in the kitchen (at least one on each side of the sink if counter tops are on each side and 12 inches or over in width).

(2) Adjacent to the refrigerator and free-standing gas-range space.

(3) At counter top spaces for built-in vanities.

(4) At counter top spaces under wall-mounted cabinets.

(5) In the wall, at the nearest point where a bar type counter attaches to the wall.

(6) In the wall at the nearest point where a fixed room divider attaches to the wall.

(7) In laundry area.

(8) At least one receptacle outlet shall be installed outdoors. Receptacle outlets located in compartments accessible from outdoors shall be considered outdoor receptacles and shall be protected as required in § 280.806(b).

(9) Adjacent to bathroom basins or integral with the light fixture over the bathroom basin.

(10) Receptacle outlets are not required in the following locations: (i) wall space occupied by built-in kitchen or wardrobe cabinets, (ii) wall space behind doors which may be opened fully against a wall surface, (iii) room dividers of the lattice type, less than 8 feet long, not solid within 6 inches of the floor, (iv) wall space afforded by bar type counters.

(e) Receptacle outlets shall not be installed in or within reach (30 inches) of a shower or bathtub space.

(f) Receptacle outlets shall not be installed above electric baseboard heaters.

**§ 280.807 Fixtures and appliances.**

(a) Electrical materials, devices, appliances, fittings, and other equipment installed, intended for us in, or attached to the mobile home shall be approved for the application and shall be connected in an approved manner when in service. Facilities shall be provided to securely fasten appliances when the mobile home is in transit. (See § 280.809.)

(b) Specifically listed pendant-type fixtures or pendant cords shall be permitted in mobile homes.

(c) If a lighting fixture is provided over a bathtub or in a shower stall, it shall be of the enclosed and gasketed type, listed for wet locations.

(d) The switch for shower lighting fixtures and exhaust fans located over a tub or in a shower stall shall be located outside the tub shower space. (See § 280.806(e).)

(e) Any combustible wall or ceiling finish exposed between the edge of a fixture, canopy, or pan and an outlet box shall be covered with noncombustible material.

(f) Every appliance shall be accessible for inspection, service, repair, or replacement without removal of permanent construction.

**§ 280.808 Wiring methods and materials.**

(a) Except as specifically limited in this Part, the wiring methods and materials specified in the National Electrical Code (NFPA No. 70—1975) shall be used in mobile homes.

(b) Nonmetallic outlet boxes shall be acceptable only with nonmetallic cable.

(c) Nonmetallic cable located 15 inches or less above the floor, if exposed, shall be protected from physical damage by covering boards, guard strips, or conduit. Cable likely to be damaged by stowage shall be so protected in all cases.

(d) Nonmetallic sheathed cable shall be secured by staples, straps, or similar fittings so designed and installed as not to injure any cable. Cable shall be secured in place at intervals not exceeding 4½ feet and within 12 inches from every cabinet, box or fitting.

(e) Metal-clad and nonmetallic cables shall be permitted to pass through the centers of the wide side of 2-inch by 4-inch studs. However, they shall be protected where they pass through 2-inch by 2-inch studs or at other studs or frames where the cable or armor would be less than 1½ inches from the inside or outside surface of the studs when the wall covering materials are in contact with the studs. Steel plates on each side of the cable, or a tube, with not less than No. 16 MSG wall thickness shall be required to protect the cable. These plates or tubes shall be securely held in place.

(f) Where metallic faceplates are used they shall be effectively grounded.

(g) If the range, clothes dryer, or similar appliance is connected by metal-clad cable or flexible conduit, a length of not less than three feet of free cable or conduit shall be provided to permit moving the appliance. Type NM or Type SE cable shall not be used to connect a range or a dryer. This shall not prohibit the use of Type NM or Type SE cable between the branch circuit overcurrent protective device and a junction box or range or dryer receptacle.

(h) Threaded rigid metal conduit shall be provided with a locknut inside and outside the box, and a conduit bushing shall be used on the inside. Rigid nonmetallic conduit shall be permitted. Inside ends of the conduit shall be reamed.

(i) Switches shall be rated as follows:

(1) For lighting circuits, switches shall have a 10-ampere, 120–125 volt rating; or higher if needed for the connected load.

(2) For motors or other loads, switches shall have ampere or horsepower ratings, or both, adequate for loads controlled. (An "AC general-use" snap switch shall be permitted to control a motor 2 horsepower or less with full-load current not over 80 percent of the switch ampere rating).

(j) At least 4 inches of free conductor shall be left at each outlet box except where conductors are intended to loop without joints.

(k) When outdoor or under-chassis line-voltage wiring is exposed to moisture or physical damage, it shall be protected by rigid metal conduit. The conductors shall be suitable for wet locations. Electrical metallic tubing may be used when closely routed against frames and equipment enclosures.

(l) The cables or conductors shall be Type NMC, TW, or equivalent.

(m) Outlet boxes of dimensions less than those required in Table 370–6(a) of the National Electrical Code (NFPA No. 70–1975), shall be permitted provided the box has been tested and approved for the purpose.

(n) Boxes, fittings and cabinets shall be securely fastened in place, and shall be supported from a structural member of the home, either directly or by using a substantial brace. Snap-in type boxes provided with special wall or ceiling brackets that securely fasten boxes in walls or ceilings shall be permitted.

(o) Outlet boxes shall fit closely to openings in combustible walls and ceilings, and they shall be flush with such surfaces.

(p) Appliances having branch-circuit terminal connections which operate at temperatures higher than 60°C (140°F) shall have circuit conductors as described in paragraph (p) (1) and (2) of this section:

(1) Branch-circuit conductors having an insulation suitable for the temperature encountered shall be permitted to run directly to the appliance.

(2) Conductors having an insulation suitable for the temperature encountered shall be run from the appliance terminal connections to a readily accessible outlet box placed at least one foot from the appliance. These conductors shall be in a suitable raceway which shall extend for at least 4 feet.

**§ 280.809 Grounding.**

(a) *General.* Grounding of both electrical and nonelectrical metal parts in a mobile home shall be through connection to a grounding bus in the mobile home distribution panelboard. The grounding bus shall be grounded through the green-colored conductor in the supply cord or the feeder wiring to the service ground in the service-entrance equipment located adjacent to the mobile home location. Neither the frame of the mobile home nor the frame of any appliance shall be connected to the neutral conductor in the mobile home.

(b) *Insulated neutral.* (1) The grounded circuit conductor (neutral) shall be insulated from the grounding conductors and from equipment enclosures and other grounded parts. The grounded (neutral) circuit terminals in the distribution panelboard and in ranges, clothes dryers, counter-mounted cooking units, and wall-mounted ovens shall be insulated from the equipment enclosure. Bonding screws, straps, or buses in the distribution panelboard or in appliances shall be removed and discarded.

(2) Connection of ranges and clothes dryers with 115/230-volt, 3-wire ratings shall be made with 4-conductor cord and 3-pole, 4-wire grounding type plugs, or by Type AC metal-clad cable or conductors enclosed in flexible metal conduit. For 115-volt rated devices, a 3-conductor cord and a 2-pole, 3-wire grounding-type plug shall be permitted.

(c) *Equipment grounding means.* (1) The green-colored grounding wire in the supply cord or permanent feeder wiring shall be connected to the grounding bus in the distribution panelboard or disconnecting means.

(2) In the electrical system, all exposed metal parts, enclosures, frames, lamp fixture canopies, etc., shall be effectively bonded to the grounding terminal or enclosure of the distribution panelboard.

(3) Cord-connected appliances, such as washing machines, clothes dryers, refrigerators, and the electrical system of gas ranges, etc., shall be grounded by means of an approved cord with grounding conductor and grounding-type attachment plug.

(d) *Bonding of noncurrent-carrying metal parts.* (1) All exposed noncurrent-carrying metal parts that may become energized shall be effectively bonded to the grounding terminal or enclosure of the distribution panelboard. A bonding conductor shall be connected between each distribution panelboard and an accessible treminal on the chassis.

(2) Grounding terminals shall be of the solderless type and approved as pressure-terminal connectors recognized for the wire size used. Star washers or other approved paint-penetrating fitting shall be used to bond terminals to chassis or other coated areas. The bonding conductor shall be solid or stranded, insulated or bare and shall be No. 8 copper mini-

mum, or equal. The bonding conductor shall be routed so as not to be exposed to physical damage. Protection can be afforded by the configuration of the chassis.

(3) Metallic gas, water and waste pipes and metallic air-circulating ducts shall be considered bonded if they are connected to the terminal on the chassis (see § 280.809) by clamps, solderless connectors, or by suitable grounding-type straps.

(4) Any metallic roof and exterior covering shall be considered bonded if (i) the metal panels overlap one another and are securely attached to the wood or metal frame parts by metallic fasteners, and (ii) if the lower panel of the metallic exterior covering is secured by metallic fasteners at a cross member of the chassis by two metal straps per mobile home unit or section at opposite ends. The bonding strap material shall be a minimum of 4 inches in width of material equivalent to the skin or a material of equal or better electrical conductivity. The straps shall be fastened with paint-penetrating fittings (such as screws and star washers or equivalent).

**§ 280.810 Electrical testing.**

(a) Dielectric Strength Test. The wiring of each mobile home shall be subjected to a 1-minute, 900-volt dielectric strength test (with all switches closed) between live parts (including neutral) and the mobile home ground. Alternatively, the test may be performed at 1,080 volts for 1 second. This test shall be performed after branch circuits are complete and after fixtures or appliances are installed. Fixtures or appliances which are listed shall not be required to withstand the dielectric strength test.

(b) Each mobile home shall be subjected to: (1) A continuity test to assure that metallic parts are properly bonded. (2) Operational test to demonstrate that all equipment is connected and in working order and (3) Polarity checks to determine that connections have been properly made.

**§ 280.811 Calculations.**

(a) The following method shall be employed in computing the supply-cord and distribution-panelboard load for each feeder assembly for each mobile home and shall be based on a 3-wire, 115/230-volt supply with 115-volt loads balanced between the two legs of the 3-wire system. The total load for determining power supply by this method is the summation of:

(1) Lighting and small appliance load as calculated below:

(i) Lighting Watts: Length times width of mobile home (outside dimensions exclusive of coupler) times 3 watts per square foot; e.g. Length × width × 3=lighting watts.

(ii) Small Appliance Watts: Number of circuits times 1,500 watts for each 20-ampere appliance receptacle circuit (See definition of "Appliance Portable" with note): e.g. Number of circuits × 1,500= small appliance watts.

(iii) Total Watts: Lighting watts plus small appliance=total watts.

(iv) First 3,000 total watts at 100 percent plus remainder at 35 percent=watts to be divided by 230 volts to obtain current (amperes) per leg.

(2) Nameplate amperes for motors and heater loads (exhaust fans, air conditioners, electric, gas, or oil heating). Omit smaller of air conditioning and heating except include blower motor if used as air conditioner evaporator motor. When an air conditioner is not installed and a 40-ampere power supply cord is provided, allow 15 amperes per leg for air conditioning.

(3) 25 percent of current of largest motor in (2).

(4) Total of nameplate amperes for: Disposal, dishwasher, water heater, clothes dryer, wall-mounted oven, cooking units. Where number of these appliances exceeds three, use 75 percent of total.

(5) Derive amperes for free-standing range (as distinguished from separate ovens and cooking units) by dividing values below by 230 volts.

| *Name plate rating (in watts)* | *Use (in watts)* |
|---|---|
| 10,000 or less | 80 percent of rating. |
| 10,001 to 12,500 | 8,000. |
| 12,501 to 13,500 | 8,400. |
| 13,501 to 14,500 | 8,800 |
| 14,501 to 15,500 | 9,200. |
| 15,501 to 16,500 | 9,600. |
| 16,501 to 17,500 | 10,000. |

(6) If outlets or circuits are provided for other than factory-installed appliances include the anticipated load. The following example is given to illustrate the application of this Method of Calculation:

*Example.* A mobile home is 70×10 feet and has two portable appliance circuits, a 1000 watt 230 volt heater, a 200 watt 115 volt exhaust fan, a 400 watt 115 volt dishwasher and a 7000 watt electric range.

| Lighting and small appliance load: | *Watts* |
|---|---|
| Lighting 70×10×3 | 2,100 |
| Small appliance 1,500×2 | 3,000 |
| Total | 5,100 |
| 1st 3,000 W at 100 pct | 3,000 |
| Remainder (5,100−3,000=2,100) at 35 pct | 735 |
| Total | 3,735 |

$$\frac{3,735}{230}=16 \text{ A per leg}$$

1,000 W (heater) ÷230=4.4 A.
200 W (fan) ÷115=1.7 A.
400 W (dishwaster) ÷115=3.5 A.
7,000 W (range)×0.8÷230=24.0 A.

| | Amperes per leg | |
|---|---|---|
| | A | B |
| Lighting and appliances | 16 | 16 |
| Heater (230 V) | 4 | 4 |
| Fan (115 V) | 2 | |
| Dishwasher (115 V) | | 4 |
| Range | 24 | 24 |
| Totals | 46 | 48 |

NOTE.—Based on the higher current calculated for either leg, use one 50-A supply cord.

(b) The following is an optional method of calculation for lighting and appliance loads for mobile homes served by a single 3-wire 115/230 volt set of feeder conductors with an ampacity of 100 or greater. The total load for determining the feeder ampacity may be computed in accordance with the following Table instead of the method previously specified. Feeder conductors whose demand load is determined by this optional calculation shall be permitted to have the neutral load determined by Section 220–22 of the National Electrical Code. The loads identified in the Table as "other load" and as "Remainder of other load" shall include the following:

(1) 1500 watts for each 2-wire, 20-ampere small appliance branch circuit and each laundry branch circuit specified.

(2) 3 watts per square foot for general lighting and general-use receptacles.

(3) The nameplate rating of all fixed appliances, ranges, wall-mounted ovens, counter-mounted cooking units, and including 4 or more separately controlled space heating loads.

(4) The nameplate ampere or kVA rating of all motors and of all low-power-factor loads.

(5) The largest of the following: (i) air conditioning load; (ii) the 65 percent diversified demand of the central electric space heating load; (iii) the 65 percent diversified demand of the load of less than four separately-controlled electric -space heating units; (iv) the connected load of four or more separately-controlled electric space heating units.

OPTIONAL CALCULATION FOR MOBILE HOMES WITH 110-AMPERE OR LARGER SERVICE

| Load (in kilowatt or kilovoltampere): | *Demand factor (percent)* |
|---|---|
| Air-conditioning and cooling including heat pump compressors | 100 |
| Central electric space heating | 65 |
| Less than 4 separately controlled electric space heating units | 65 |
| 1st 10 kW of all other load | 100 |
| Remainder of other load | 40 |

**§ 280.812 Wiring of expandable units and dual units.**

(a) Expandable or multiple unit mobile homes shall use fixed-type wiring methods and materials for connecting such units to each other.

(b) Expandable or multiple unit mobile homes not having permanently installed feeders and which are to be moved from one location to another, shall be permitted to have disconnecting means with branch circuit protective equipment in each unit when so located that after assembly or joining together of units the requirements of § 280.803 will be met.

**§ 280.813 Outdoor outlets, fixtures, air-conditioning equipment, etc.**

(a) Outdoor fixtures and equipment shall be listed or approved for outdoor use. Outdoor receptacles or convenience outlets shall be of a gasketed-cover type.

(b) A mobile home provided with an outlet designed to energize heating and/or air conditioning equipment located outside the mobile home, shall have per-

manently affixed, adjacent to the outlet, a metal tag which reads:

This Connection Is for Air Conditioning Equipment Rated at Not More Than _____ Amperes, at _____ Volts, 60 Hertz. A disconnect shall be located within sight of the appliance.

The correct voltage and ampere ratings shall be given. The tag shall be not less than 0.020 inch, etched brass, stainless steel, anodized or alclad aluminum or equivalent. The tag shall be not less than 3 inches by 1¾ inches minimum size.

**§ 280.814 Painting of wiring.**

During painting or staining of the mobile home, it shall be permitted to paint metal raceways (except where grounding continuity would be reduced) or the sheath of the nonmetallic cable. Some arrangement, however, shall be made so that no paint shall be applied to the individual wires, as the color coding may be obliterated by the paint.

**§ 280.815 Polarization.**

(a) The identified (white) conducter shall be employed for grounding circuit conductors only and shall be connected to the identified (white) terminal or lead on receptacle outlets and fixtures. It shall be the unswitched wire in switched circuits, except that a cable containing an identified conductor (white) shall be permitted for single-pole three-way or four-way switch loops where the connections are made so that the unidentified conductor is the return conductor from the switch to the outlet. Painting of the terminal end of the wire shall not be required.

(b) If the identified (white) conductor of a cable is used for other than grounded conductors or for other than switch loops as explained above (for a 230-volt circuit, for example), the conductor shall be finished in a color other than white at each outlet where the conductors are visible and accessible.

(c) Green-colored wires or green with yellow stripe shall be used for grounding conductors only.

**§ 280.816 Examination of equipment for safety.**

The examination or inspection of equipment for safety, according to this standard, shall be conducted under uniform conditions and by organizations properly equipped and qualified for experimental testing, inspections of the run of goods at factories, and service-value determinations through field examinations.

## Subpart J—Transportation

**§ 280.901 Scope.**

Subpart J of this Standard covers the general requirement for designing the structure of the mobile home to fully withstand the adverse effects of transportation shock and vibration without degradation of the integrated structure or of its component parts and the specific requirements pertaining to the transportation system and its relationship to the structure.

**§ 280.902 Definitions.**

(a) "Chassis" means the entire transportation system comprising the following subsystems: drawbar and coupling mechanism, frame, running gear assembly, and lights.

(b) "Drawbar and Coupling Mechanism" means the rigid assembly, (usually an "A" frame) upon which is mounted a coupling mechanism, which connects the mobile home's frame to the towing vehicle.

(c) "Frame" means the fabricated rigid substructure which provides considerable support to the affixed mobile home structure both during transport and on-site; and also provides a platform for securement of the running gear assembly, the drawbar and coupling mechanism.

(d) "Running Gear Assembly" means the subsystem consisting of suspension springs, axles, bearings, wheels, hubs, tires, and brakes, with their related hardware.

(e) "Lights" means those safety lights and associated wiring required by applicable U.S. Department of Transportation regulations.

(f) "Transportation System," (Same as Chassis, above).

(g) "Highway," includes all roads and streets to be legally used in transporting the mobile home.

(h) "Length," for purposes of transportation only, means the distance from the extreme front of the mobile home to the extreme rear, including the drawbar and coupling mechanism, but not including expandable features that do not project from the body during transportation.

**§ 280.903 General requirements for designing the structure to withstand transportation shock and vibration.**

(a) The cumulative effect of highway transportation shock and vibration upon a mobile home structure may result in incremental degradation of its designed performance in terms of providing a safe healthy and durable dwelling. Therefore, the mobile home shall be designed, in terms of its structural, plumbing, mechanical and electrical systems, to fully withstand such transportation forces during its intended life. (See §§ 280.303 (c) and 280.305(a)).

(b) Particular attention shall be given to maintaining watertight integrity and conserving energy by assuring that structural components in the roof and walls (and their interfaces with vents, windows, doors, etc.) are capable of resisting highway shock and vibration forces during primary and subsequent secondary transportation moves.

(c) In place of an engineering analysis, either of the following may be accepted: (1) Documented technical data of suitable highway tests which were conducted to simulate transportation loads and conditions; or (2) acceptable documented evidence of actual transportation experience which meets the intent of this subpart.

**§ 280.904 Specific requirements for designing the transportation system.**

(a) *General.* The entire system (frame, drawbar and coupling mechanism, running gear assembly, and lights) shall be designed and constructed as an integrated, balanced and durable unit which is safe and suitable for its specified use during the intended life of the mobile home. In operation, the transportation system (supporting the mobile home structure and its contents) shall effectively respond to the control of the towing vehicle in terms of tracking and braking, while traveling at applicable highway speeds and in normal highway traffic conditions.

(NOTE: While the majority of mobile homes utilize a fabricated steel frame assembly, upon which the mobile home structure is constructed, it is not the intent of this standard to limit innovation. Therefore, other concepts, such as integrating the frame function into the mobile home structure, are acceptable provided that such design meets the intent and requirements of this part).

(b) *Specific requirements*—(1) *Drawbar.* The drawbar shall be constructed of sufficient strength, rigidity and durability to safely withstand those dynamic forces experienced during highway transportation. It shall be securely fastened to the mobile home frame by either a continuous weld or by bolting.

(2) *Coupling mechanism.* The coupling mechanism (which is usually of the socket type) shall be securely fastened to the drawbar in such a manner as to assure safe and effective transfer of the maximum loads, including dynamic loads, between the mobile home structure and the hitch-assembly of the towing vehicle. The coupling shall be equipped with a manually operated mechanism so adapted as to prevent disengagement of the unit while in operation. The coupling shall be so designed that it can be disconnected regardless of the angle of the mobile home to the towing vehicle. With the mobile home parked on level ground, the center of the socket of the coupler shall not be less than 20 inches nor more than 26 inches from ground level.

(3) *Chassis.* The chassis, in conjunction with the mobile home structure, shall be designed and constructed to effectively sustain the designed loads consisting of the dead load plus a minimum of 3 pounds per square foot floor load, (example: free-standing range, refrigerator, and loose furniture) and the superimposed dynamic load resulting from highway movement but shall not be required to exceed twice the dead load. The integrated design shall be capable of insuring rigidity and structural integrity of the complete mobile home structure and to insure against deformation of structural or finish members during the intended life of the home.

(4) *Running gear assembly.* (i) The running gear assembly, as part of the chassis, shall be designed to perform, as a balanced system, in order to effectively sustain the designed loads set forth in § 280.904(b)(3) and to provide for dur-

able dependable safe mobility of the mobile home. It shall be designed to accept shock and vibration, both from the highway and the towing vehicle and effectively dampen these forces so as to protect the mobile home structure from damage and fatigue. Its components shall be designed to facilitate routine maintenance, inspection and replacement.

(ii) Location of the running gear assembly shall be determined by documented engineering analysis, taking into account the gross weight (including all contents), total length of the mobile home, the necessary coupling hitch weight, span distance, and turning radius. The coupling weight shall be not less than 12 percent nor more than 25 percent of the gross weight.

(5) *Spring assemblies.* Spring assemblies (springs, hangers, shackles, bushings and mounting bolts) shall be capable of withstanding all the design loads as outlined in 280.904(b)(3) without exceeding maximum allowable stresses for design spring assembly life as recommended by the spring assembly manufacturer. The capacity of the spring system shall assure, that under maximum operating load conditions, sufficient clearance shall be maintained between the tire and mobile home frame or structure to permit unimpeded wheel movement and for changing tires.

(6) *Axles.* Axles, and their connecting hardware, shall be capable of withstanding all of the design loads outlined in § 280.904(b)(3) without exceeding maximum allowable stresses for design axle life as recommended by the axle manufacturer. The number of axles required to provide a safe tow and good ride characteristics shall be determined and documented by engineering analysis. Those alternatives listed in § 280.903(c) may be accepted in place of such an analysis.

(7) *Hubs and bearings.* Hubs and bearings shall meet the requirements of § 280.904(b)(3) and good engineering practice. Both of these components shall be accessible for inspection, routine maintenance and replacement of parts.

(8) *Tires, wheels and rims.* Tires, wheels and rims shall meet the requirements of § 280.904(b)(3). Tires shall be selected for anticipated usage.

(9) *Brake assemblies.* (i) The number, type, size and design of brake assemblies required to assist the towing vehicle in providing effective control and stopping of the mobile home shall be determined and documented by engineering analysis. Those alternatives listed in § 280.903(c) may be accepted in place of such an analysis.

(ii) Brakes on the towing vehicle and the mobile home shall be capable of assuring that the maximum stopping distance from an initial velocity of 20 miles per hour does not exceed 40 feet (U.S. Department of Transportation Regulations).

(10) *Lights and associated wiring.* Highway safety electrical lights and associated wiring shall conform to applicable federal requirements in terms of location and performance. The manufacturer shall have the option of meeting this requirement by utilizing a temporary light/wiring harness provided by the mobile home transportation carrier.

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